



This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

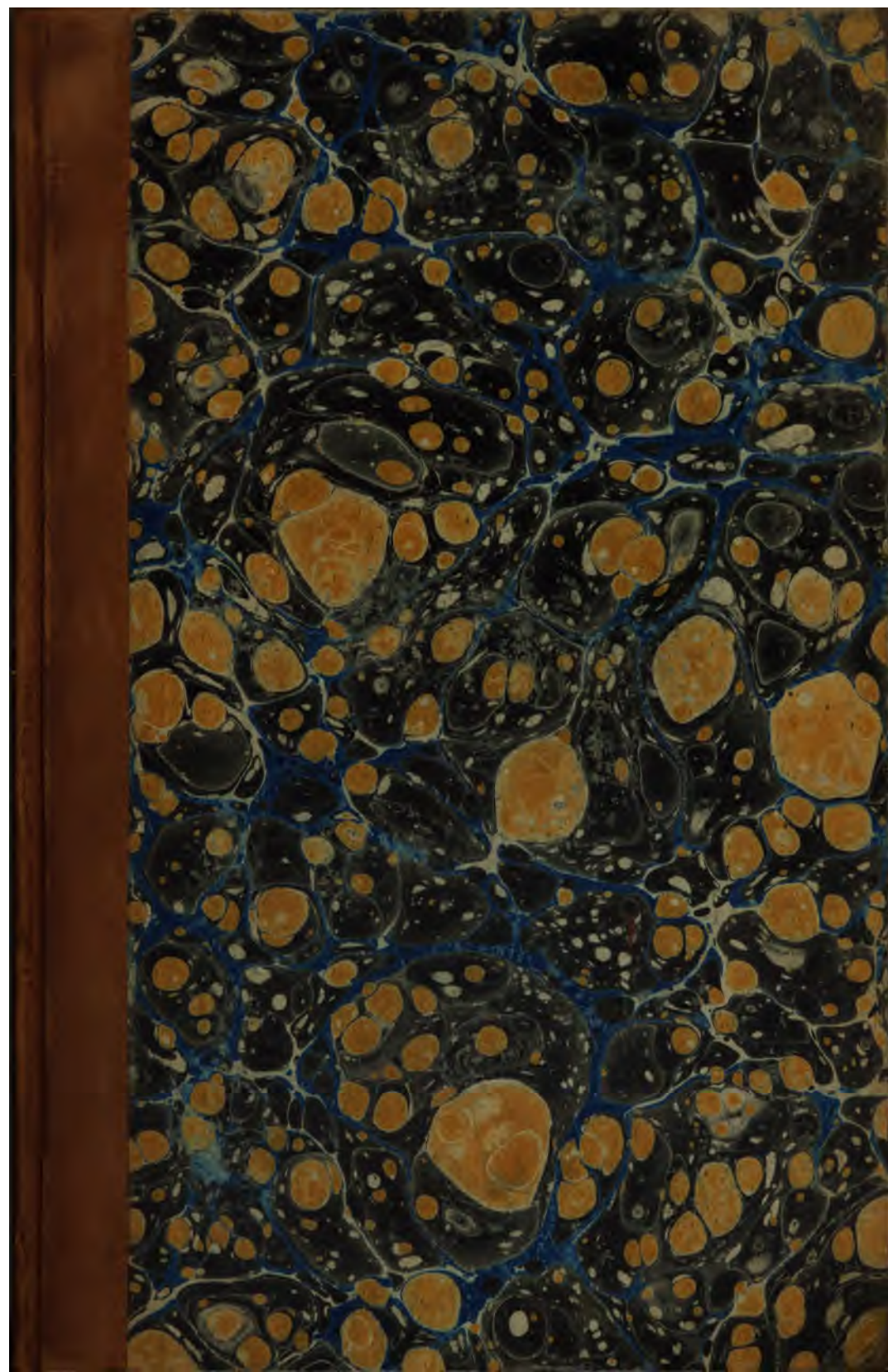
Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

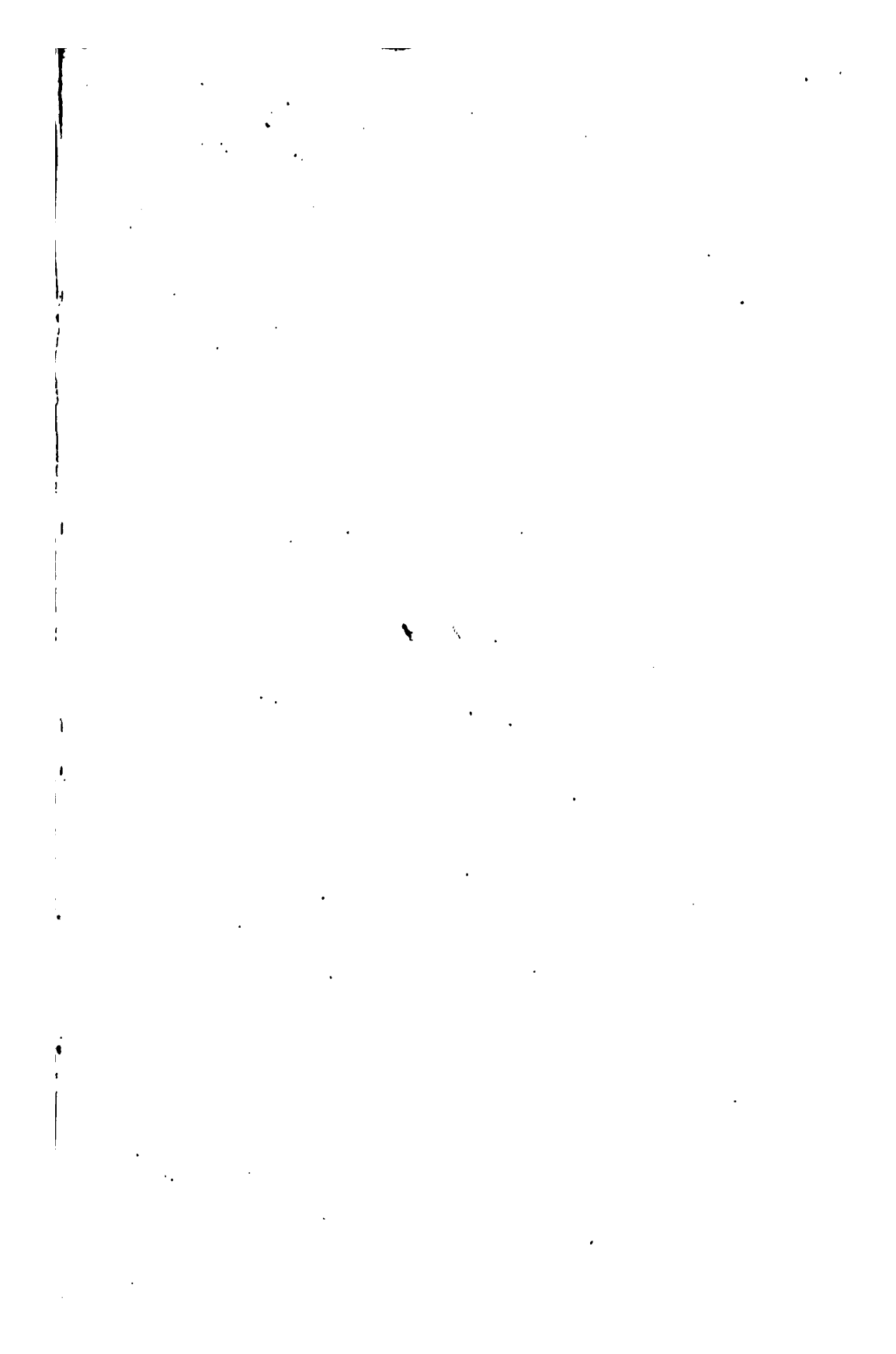
- + *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
- + *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
- + *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
- + *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at <http://books.google.com/>



47. 404.



RAILWAYS

IN

INDIA.



BY AN ENGINEER.

LONDON:

JOHN WILLIAMS & Co., 193, STRAND.

1847.

LONDON:
DRURY, *Printer*, 31, Bartlett's Buildings, Holborn.

SUMMARY OF CONTENTS.

For the accommodation of such persons as may desire to acquaint themselves with the contents of the following pages without the trouble of wading through them, a summary is here given of the chief conclusions arrived at.

The East Indian Line is the most important in India, both in its political and commercial fruits. It connects Calcutta with the North West Provinces, and if opened as a single line costing £10,000 per mile, and the traffic at present existing be alone reckoned as available for its support, it will return a profit of upwards of 21 per cent. upon the capital; but as in India a large increase of traffic invariably follows every amelioration of the means of transport, a still larger profit than this may fairly be expected. If the line be opened as a double line, costing £18,000 per mile, the profit will not be half as great as before, in consequence of the greater depreciation; and a single line is sufficient for the traffic, even if quadrupled, for there is no necessity that the trains should be frequent, although they must be large. A *piece* of railway extending from Calcutta towards Mirzapore would not be profitable, whereas a piece of railway extending from Mirzapore towards the North West Provinces, would probably be a good investment. It would be unwise, however, to make the line connecting Calcutta with Mirzapore to follow the valley of the Ganges, both because a high speed between the termini is impossible upon a circuitous line, and because every mile over which a train is needlessly carried, involves an extra expense in constructing and working the line. 1,000,000

tons of goods, and 500,000 passengers, carried over 100 miles of additional railway, would involve a charge of £520,832, at the rates fixed for the East Indian line; the depreciation would be £180,000 per annum, if the line were a double one, making together upwards of £700,000 per annum, to be fixed as a tax upon the public, if the railway profits are to undergo no diminution.

The profits of the Indian Peninsula Railway are estimated at 11 per cent., and of the Madras Railway, at 6 per cent., without reckoning anything for the increase of traffic the railways will create, and a government guarantee of 4 per cent. upon 7 millions distributed among the East Indian, Peninsula, and Madras Railways could probably be insured for 5 per cent., or £14,000 a year. For this guarantee, those lines should make corresponding concessions, and with the guarantee and with the aid of railway notes, redeemable in transport, they would be able to proceed to the development of their various projects without either doubt or delay. The dividend permissible should be inversely proportional to the rate of tariff adopted, whereby a perpetual temptation would be presented to reduce the charges to the public. The offer said to have been made to the East Indian Railway Company, of a guarantee upon 3 millions for 15 years, with a lease of 99 years, is less eligible to the government than the arrangement suggested of a guarantee on 7 millions with corresponding concessions, while it is invidious towards the other companies. The East Indian Railway Company, however, has no reason to quarrel with the decree, as it accords that company a liberty of action which could not exist under the other arrangement. The passenger traffic on the East Indian Line, it may be added, is twice greater than upon the London and Birmingham Railway during its first year, and the goods' traffic eighteen times greater.

RAILWAYS IN INDIA.

CHAPTER I.

RAILWAYS IN BENGAL.

OF the various railways projected in Bengal, the East Indian Railway and the Great Western of Bengal are now almost the only survivors. The East Indian line runs from Calcutta, through Mirzapore, Allahabad, and other great commercial marts in the interior, to Delhi, in the North-west provinces, and is with its various branches above 1,000 miles long; the Great Western of Bengal is about 180 miles long, and extends from Calcutta to Rajmahal, a town at the head of the Delta of the Ganges. The East Indian line will open up the most important districts of India, many of which are now inaccessible to commerce, and will, moreover, in consequence of the facilities it will afford for the rapid transport of troops, constitute a most powerful political engine for preserving the tranquillity of the country. The Great Western of

East Indian
and Great
Western of
Bengal Rail-
ways.

Great West-
ern of Ben-
gal superfluous as a
trunk, and
premature as
a branch.

Bengal, on the contrary, aspires to do nothing more than to lend some new aids to the Ganges trade ; but, as the formation of the East Indian line appears to be inevitable, and as it must, when completed, attract to itself the best portion of the Ganges trade, the Great Western of Bengal appears to be providing for a want that must be on the eve of extinction, before that line could even be opened to the public. Apart however from this consideration, it is doubtful whether a railway, extending from Calcutta to Rajmahal, would become the medium for the transmission of any material proportion of the Ganges trade ; for though the shoals of the Bhagarutty and the sinuous channels of the Sunderbunds would be avoided by the use of such a railway, yet a transshipment of merchandise would be the inevitable concomitant of the proposed mode of transport, and experience has shown that transshipment is a greater evil than any of the ordinary impediments of navigation. The Glasgow and Greenock, Dublin and Kingston, London and Blackwall, and several other railways in this country, were constructed chiefly with the view of receiving the cargoes of ships at a point of easy access, and transmitting them expeditiously to their several destinations ; and it was expected that ships would avail themselves largely of the facilities thus placed at their disposal to escape the difficulties incidental to the navigation of the worst parts of the Clyde, the Liffey, and the Thames. But in no one instance have these expectations been verified

by the result. Ships still persist in passing up to Dublin, instead of stopping short at Kingston harbour; they pass on to Glasgow or the Tower, in spite of the shallows of the Clyde, or the obstructions of the Pool; and there is no reason to believe that in India they would manifest a greater docility. All analogy assures us that cargoes of merchandise, when once embarked upon the Ganges, would not be disembarked until they reached their destination at Calcutta; but, as the East Indian railway extends unto the districts from which the Ganges cargoes are received, it is equally certain that, instead of being embarked upon the river, they would be embarked upon the railway, provided the railway could carry them as cheaply and as well. In such a contingency, the Great Western of Bengal railway, though it might be used for the transmission of parcels, and a few light wares, would obviously be a superfluity so far as regards the general Ganges trade; while, on the supposition that railway cannot be rendered as cheap as river carriage, the increased expense of the railway must be added to the evils of transshipment in discouragement of this hybrid reticulation of transport. It may no doubt be the fact, that the local traffic of the districts around Rajmahal is sufficient of itself to support a railway, but the same thing might be predicated of many other districts of India, and it is impossible to raise a claim for priority of construction on the strength of such pretensions. The most important lines must obviously be the first that are underta-

Railways dependent on the cargoes of ships have never answered.

The most important lines must be the first undertaken, and Government virtually pledged to the trunk line.

ken. At the institution of railways in this country, nobody thought of opening a railway to Beverley, before undertaking one to Birmingham; and still less would any such proposal have been countenanced, if the formation of the more important line had rendered the existence of the other superfluous for all its professed objects. The railway commission, which must be regarded as the official organ of the Indian Government, has decided that politically, socially, and commercially, the East Indian line is the most important in India, and the government has certified to the public their acquiescence in this judgment, by the offer of a guarantee of 4 per cent. for a limited period upon the capital to be invested. It is impossible, after this public recognition of the superior claims of the trunk line to select a branch line of inferior importance, as the first to be undertaken. The government is not pledged to any particular company, but it is pledged to a particular scheme, and it is bound to carry that scheme into effect under the best guarantees for the public accommodation that are obtainable. To substitute another scheme now, for that which has been already selected, would only be to stultify the government in all its past proceedings; it would be to declare that either its first choice was precipitate, or its proposed substitution indefensible; and to encourage the belief, that its decisions rest upon some other basis than is afforded by those fixed and equitable principles which disclaim changes without a cause. There is, indeed,

no probability that the government is disposed to pursue such dangerous courses ; but it is important to understand that the vacillations are impossible, upon which some persons appear to rely. The government, by its acts, is virtually pledged that the trunk line shall be the one first constructed ; many persons have bought or retained shares in that line on the strength of the government declaration, and the public voice, which at the present juncture the Indian government cannot afford to despise, would certainly swell the cry these persons would raise, if the government were to deceive them by abandoning its engagements or changing its policy without the advent of any new lights that were capable of changing its faith.

The government cannot adopt a subordinate line for a commencement with either credit or safety.

The East Indian Railway had its origin in the exertions of Mr. R. Macdonald Stephenson, who, after acting as secretary of the East Indian Steam Navigation Company, and devoting many subsequent years to subjects connected with the development of the resources of India, proceeded to Calcutta, and, after conferring with the government there on the subject of Indian railways, and collecting a large amount of important information bearing upon their commercial and engineering features, returned to England to press the subject upon the consideration of the authorities at home. Of course his communications were received at first with much apathy and scepticism, but by degrees his doctrines were endured and finally embraced ; and a company, numbering some of the

Origin of the East Indian line.

Origin of the
East Indian
line.

chief merchants of London, and with a capital of £10,000,000 sterling, was formed with the concurrence of the Indian government, to carry his views into practical effect.

The Court of Directors of the India House, in a despatch to the Governor-General, dated May 7th, 1845, intimated that they had appointed a civil engineer to proceed to India, with whom some engineer officers in the Company's service were to be associated, in a commission which was to ascertain the practicability or benefit of introducing railways into India; and the opinion of the Indian executive was requested upon the conclusions at which this commission arrived. The engineers reported "that railroads are not inapplicable to the peculiarities and circumstances of India, but on the contrary, are not only a great desideratum, but, with proper attention, can be constructed and maintained as perfectly as in any part of Europe." In this opinion all parties now appear to acquiesce, though at the outset doubts were raised and difficulties magnified, as is the fashion in such cases; but practical investigation has dispelled the mists in the impenetrability of which such scepticism confides.

It was one of the functions committed to the engineers to report upon the best line for connecting Calcutta with the north-west provinces. Several lines were examined, but the one to which a preference was given may be traced by the help of the following indications: leaving Calcutta at its

northern extremity the line would pass along the eastern bank of the Hoogly so as to escape the effects of the inundation when the Damooda bursts or overflows its banks—near Cossipore, Barrackpore to Goonpalla, Ranaghat, crossing the Matabhanga river, crossing the road to Kishnagur near Dinagur, curving to the north-west and crossing the Hoogly at Panchilla factory, through Singalee to Baljoore and Balkishun 10 miles north of Burdwan. From Balkishun the line would proceed to Kagsa, thence along the left bank of the Damooda to Raneegunge collieries, pass near the junction of the Barrakur river with the Damooda, up the valley of the Barrakur, near the Dhunwar Pass where the gradients would be severe, across the plains of Behar to Shahurghatee, Nourungabad, crossing the Soane river 2 miles and 3 furlongs in breadth, where the substratum is an unknown depth of sand, thence along the foot of the hills to Saseram, to Chunar and thence along the foot of the Hills circuitously to avoid bad ground to Mirzapore. In this section, which is 448 miles long, there are two branches which it appears expedient to execute—one leaving the main line 5 miles east of Shahurghatee, and passing through Gyah and Patna to Dinapore, the length being 80 miles; and the other leaving the main line 9 miles before reaching Chunar, and proceeding to Rajhgarh, opposite Benares, the length of which is 17 miles. The total length of the section extending from Calcutta to Mirzapore with its branches would therefore be

Course of the
East Indian
line.

Course of the
East Indian
line.

545 miles. Patna, Dinapore, Benares and Mirzapore, are all upon the Ganges.

The section of the line extending from Mirzapore to Delhi would cross the Tonse river to Allahabad, near which it would cross the Jumna, thence pass to Futtehpore, Cawnpore, Mynpooree and Allyghur on to Delhi. The chief branches recommended are one from the main line, at a point 60 miles north-west of Cawnpore to Ferruckabad, the length of which is 32 miles; from Secundra on the main line to Agra, 40 miles; and from Delhi to Meerut, 36 miles. The length of the line from Mirzapore to Delhi is 452 miles, and of the branches 108 miles, making a length of 560 miles for this section of the general scheme, or 1,105 miles for the length of the whole line from Calcutta to Delhi, with its principal branches.

Whatever be the merits of this enterprise as a commercial undertaking, it is clear, that its accomplishment would be productive of great advantages to the Indian government. Not only would such a railway make the government of the country more easy, and its tenure more secure, but by bringing neglected land into cultivation for the productions of which a profitable market could be found if easy access to a seaport were provided, it would be the means of increasing materially the public revenue, of which the land-tax is in India the principal source.

As the Indian government would be the first recipient of the benefits the railway would confer,

and would reap those benefits whether it was profitable or not to the projectors, the Railway Company has required from the government a guarantee that if the profits do not reach four per cent. the government will make them up to that sum ; and has further suggested, that inasmuch as many persons would be deterred from the investment of their money in Indian lines, by the length of time which must elapse before they become profitable, if the guarantee only comes into operation when the lines are completed, it is expedient that the four per cent. should become payable from the time the money is invested, which it is clear, unless by dividing the capital, the government alone can make possible.

Benefits of
the under-
taking to the
government.

The Court of Directors of the India House at first thought a guarantee of any kind very objectionable, yet they ultimately agreed to give one for 15 years ; but this proposal the Railway Company is said to have declined—representing that it was indispensable to the prosecution of the undertaking, that the guarantee should be made perpetual, or at least be materially extended. There is very little doubt that the India House will accede to this requisition, as the refusal of a moderate guarantee, once demanded, would be fatal to the undertaking by disseminating the belief that those best qualified to judge of its success, apprehended that there was a risk in giving a guarantee upon it of four per cent. ; for a refusal is inexplicable without the supposition of such an apprehension.

Question of
a guarantee.

It has been objected to the plan of dating the guarantee from the time the money is invested, that instead of being a plan for making railway investments safe, it is an attempt to make the capital of the company yield in two ways—immediately from the payment of government interest upon it, as if government were employing it, and prospectively from the profits of the railway, in the construction of which it is actually employed. It is clear, however, that no person would think of investing capital in railway works in India, unless a fair return is to be got from it during the *whole* time of the investment ; and if for a certain number of years the capital is to remain unproductive, a return large enough to make up this deficiency, must be obtainable from it in the years succeeding. The government may either grant this return in money, which obviously merely alters the form of the arrangement, without affecting the substance ; or they may grant it in privileges, perquisites, and monopolies, which is of all payments the most impolitic and expensive ; but they must grant it *in some shape or other*, to justify the investment of the capital. In the one case the government by the imposition of a tax, or by the loan of its credit makes an advance, to enable the railway company to give some return upon their capital while it lies unproductive ; in the other case it gives no intermediate interest but empowers the company, by way of equivalent, to tax the public for themselves in the shape of railway charges ; and this

power must be accorded to so large an extent, as to indemnify the railway company for all the risks, expenses, and blunders of the operation. People will be content with none other than exorbitant gains, where they are to be paid in chances; especially when they know so little of the country in which their capital is to be invested, as to be unable to estimate duly what those chances are; and are beset by all the doubts and jealousies of a little knowledge. An enterprise that is dark is as unpopular as one that is dangerous; and in dealing with the question of introducing railways into a country, of which the English public in reality knows nothing, the railway company has acted with a wise moderation, in seeking to gain for the shareholders, not enormous possible gains, but sure moderate profits. Nor can the company be accused of attempting unfairly to appropriate both the immediate and prospective advantages, if in asking for the one they are willing to surrender a fair proportion of the other; and certainly the requisition in question must be supposed to be suggested by the desire to make railways more safe, rather than to make them more productive. The money to be invested by the railway company is virtually a loan to the government; and if the government in raising the money would have to pay 6 per cent. in India, and the railway company lends the money in India at 4 per cent., the company manifestly saves the government 2 per cent. of risk by the transaction. If, then, the

Question of
a guarantee.

Railway investments virtually a loan to the government, part of the interest on which is paid by way of guarantee, and part by chances of additional gain.

prospects of the railway are sufficiently uncertain to make the 4 per cent. guarantee of any value, the 2 per cent. of risk incurred by the company can only be repaid by chances of gain many times exceeding that amount; for if, at 4 per cent., the risk of the railway dividend be taken at par, it is many times more likely that it will not reach 6 per cent. than that it will exceed 8 per cent., and the railway company would not therefore be indemnified for its 2 per cent. of risk, by the power to receive 2 per cent. of profit; the chances of any increase in the profits diminishing with every rise in the rate of dividend.

Whether, at 4 per cent., there is the same chance of an excess in the returns as of a deficiency, is of course only to be determined by comparing the probable cost with the probable traffic of the line; but the supposition of a risk is necessary, to give a value to the guarantee proportionate to the concession demanded in the limitation of the fares. The case we have taken sufficiently illustrates the fact, that the risks of a railway returning 6 per cent. are infinitely greater than that it will return nothing; and inasmuch as the chances of an excess rapidly diminish in number with an increase in the rate of dividend, that it requires those chances after passing 6 per cent., to be such as will authorise the gain of a large amount, to be equivalent to 2 per cent. of certainty.

Possibly the chance of realising 4 or 6 per cent. for a period of years over and above the 4 per cent.

of interest, might be an equitable recompense for the 2 per cent. of reduction in the interest the railway company achieves. This is equivalent to a limitation of the railway dividend to 10 or 12 per cent., which the railway company would probably hardly regard as a sufficient indemnity; but the design of these remarks is rather to exemplify the principle, than to fix the amount. It is clear, however, that such a dividend affords nothing more than simple interest of money, and insurance of the risk, and operates neither in redemption of the capital, nor as a commutation of the interest, until the capital becomes productive; and it is absurd, therefore, to suppose that a forfeiture should be submitted to on these portions of the general account.

The capital invested in railways should be recoverable when the government takes the railways into its hands.

Nor does it in any way affect this argument, that the use of the land for the railway is granted by the government without any payment; for if it were necessary that the land should be bought or rented, a guarantee on a larger capital would have become indispensable, and the amount of the guarantee must also have been increased, in consequence of the diminished prospect of profits incidental to the increased cost of the line. It does not, therefore, appear inequitable, that the railway company should look for a moderate return upon their capital, from the time of its investment and its ultimate redemption, when the proprietorship of the railway is assumed by the government, combined with the power of realizing such a rate of dividend

Virtual identity of different modes of agreement which require only a fair return upon the capital.

for a period of years, as will be a fair equivalent for the risk and trouble incurred in the undertaking. There is, in truth, no real difference between this demand and that involved in the offer to construct the railway without any intermediate payment of interest, and to surrender it without redemption after a period of years. In the latter case the powers of exaction must be so great, and the period of the lease so protracted, as to more than balance the benefits conceded ; and if the two proposals be substantially the same, it certainly behoves the government to adopt that form which will be most acceptable to the public, because most easily comprehended by them, and which will best facilitate the collection of the capital, and the satisfactory working of the scheme.

But while justice, as well as sound policy, requires that the companies adventuring their capital in Indian railways should be dealt with in a considerate and liberal manner, it is necessary to remember that it is for the benefit of the public, and not for the profit of companies, that railways should be established ; and every precaution should be taken against the introduction of a railway monopoly into India, such as prevails in this country. Of course duplicate lines should not be sanctioned, as that would have no other effect than to occasion a needless waste of money ; but it is worthy of consideration whether the government, or any other parties it might depute or permit, should not have the power of running engines upon the rail-

way, on the payment of a fixed toll to the company. This plan, indeed, has the obvious objection that the risk of accidents might be increased, and in India, perhaps, there are no parties fit to be trusted with so great an experiment; but the public must be protected in some way or other, and either this or some other expedient must be devised for the purpose, unless a sufficient guarantee is afforded, by the appropriation of the surplus above a fair dividend to the reduction of the rates of charge to the public.

Checks against monopoly and proposal to make the dividend permissible, dependent upon the rates charged for transport.

The common mode of limiting the dividend, however, has not been found to operate satisfactorily in other cases, for any excess has generally been squandered or jobbed away; and even in this country it has been impossible to impose an effectual check upon such practices. It appears, therefore, to be the more judicious course to make the amount of dividend permitted contingent upon the rates charged for transport; so that there would be a perpetual temptation to reduce the railway fares, inasmuch as a large dividend would be obtainable on no other terms. Taking, for example, the rates of charge upon the London and Birmingham Railway as a standard, a dividend of 12 or 15 per cent.—10 per cent. being the current rate of interest in India,—might be permitted with those charges, if such a dividend could be realised; or twice the dividend might be permitted, if the charges were reduced one half, and so on in all other proportions.

Rates of
charge on
different
lines.

In this country railway companies have generally fixed their fares so as to realise the maximum of profits, without any regard to the interests of the public; 30 per cent. has been added to fares, to gain an increased return of 1 or 2 per cent., the difference having been lost by the diminution of traffic, but by the plan proposed, the maximum of profit could only be realised by giving the maximum of benefit to the public. Every increase of dividend would necessarily bring with it a diminution of charge; and an increased prosperity would hardly be grudged to the company which was both the measure and the fruit of the increased public accommodation. Economy would no doubt be promoted, and activity secured, when the product of those virtues was divisible as profits; whereas, by confiscating any excess of profits above a certain sum, this necessary stimulus would be taken away, and an eternal suasory be presented to profligacy and supineness.

The rates of charge for passengers on the London and Birmingham Railway are—1st. class, $2d.$ per mile; 2nd class, $1\frac{1}{2}d.$ per mile; and 3rd class, $1d.$ per mile. On the French railways the charges are—1st class, $1\frac{3}{4}d.$ per mile; 2nd class, $1\frac{1}{4}d.$ per mile; and 3rd class, $\frac{2}{3}d.$ per mile; which are lower than the London and Birmingham rates by $\frac{1}{2}d.$, $\frac{1}{4}d.$, and $\frac{1}{10}d.$ per mile respectively. But on the French lines passengers are not allowed to carry so much luggage, are not carried so fast, and do not enjoy the benefits of day tickets; and with

these adjustments the fares are in reality brought very nearly to an equality. Fish on the French lines is charged 8.37*d.* per ton per mile. Goods, 1st class, 3.03*d.*; 2nd class, 2.69*d.*; and 3rd class, from 2.35*d.* to 1.67*d.* per ton per mile. Bullocks are charged 1.66*d.* per mile each; calves, 0.56*d.*; and sheep 0.34*d.* per mile each. On the London and Birmingham Railway goods not classed are charged 2.5*d.* per ton per mile; goods, 1st class, are charged 2*d.* per ton per mile: 2nd class, 1.47*d.*; and 3rd class, 1.25*d.* Oxen are charged 0.83*d.* per mile each; calves, 0.19*d.*; sheep, 0.15*d.*; and pigs, 0.15*d.* per head per mile. These rates, it will be remarked, are all much below those of the French railways, and should therefore be accepted in preference by the government, as the basis for the tariff of the Indian lines.

Rates of
charge on
different
lines.

The line selected by the government engineers for connecting Calcutta with the north-west provinces presents very few engineering difficulties, and may be constructed at a moderate cost: it passes through cities nursed into importance by the facilities of transport afforded by the Ganges, and between which and Calcutta a large traffic is already maintained, so that its commercial prospects have not to be created; while its political and military benefits, in tying the distant ends of the empire together, and enabling troops to be concentrated with a magical rapidity on any desired point of the frontier, are so numerous and momentous, that it needs an effort of the imagina-

Military and
agricultural
uses of rail-
ways.

tion to comprehend all their value. But the military advantages of railways, though necessarily great in a country such as India, are probably inferior in value to the services they appear capable of rendering to agriculture. Not only will they be the means of bringing waste land into cultivation, by affording an outlet for its produce, and of stimulating production—which in India may be rendered illimitable if the necessary demand be only created—but they will enable land at present under cultivation, to be cultivated far more perfectly, by the new facilities afforded for the transport of lime, manure, and other materials necessary to agricultural improvement. Lime is one of the necessities of agricultural life; and it may be reckoned that every acre of land requires 6 cwt. of lime, per annum, to keep it in good condition. Supposing the lime to be only from 15 to 20 miles distant, the mere saving in the cost of carriage upon this one article would be equal to 1*s.* 6*d.* per acre per annum; and even in localities not more than from 15 to 20 miles from the port at which the produce was shipped, the saving accomplished by the formation of a railway would be equivalent to not less than 4*s.* per acre, per annum.

In the transport of draining tiles, railways would also prove of material service; but the chief benefit must lie in the transport of articles of current consumption or production. It appears very important that ramifications from the trunk line, constructed on the cheapest possible principle,

should be so led as to afford effectual agricultural accommodation; and many of these branches could be made without iron rails, the wheels, which would require to be rather broader than usual, running merely on the longitudinal wooden sleepers. Such railways would be perfectly effectual, would give vast accommodation, and be very much cheaper than roads. It is desirable, too, that, where practicable, the railway tracks should be made available, as far as possible, for conducting the water required for the supply of towns, or for the purposes of irrigation, as well as for the accommodation of the pipes carrying gas into towns, and sewerage water out of them.

Agricultural
uses of rail-
ways.

Concurrently with the introduction of railways, the government—which is in India the chief owner of the land—must be prepared to grant leases sufficiently long to induce the investment of capital in agricultural improvements; with an undertaking, that an allowance shall be made for all unexhausted improvements at the expiration of the term. With these impediments to amelioration removed, and with the markets of England open, and inviting the approach of Indian productions, who shall undertake to specify the rate at which India will advance to greatness? In sugar, cotton, and other tropical productions a large export trade already exists; and in grain—of which very little has hitherto been brought from India to this country—a large trade will probably spring up, so soon as the railways enable it to reach the coast, by diminishing the expense of transport. It is true

Military and
agricultural
uses of rail-
ways.

tion to comprehend all their value. But the military advantages of railways, though necessarily great in a country such as India, are probably inferior in value to the services they appear capable of rendering to agriculture. Not only will they be the means of bringing waste land into cultivation, by affording an outlet for its produce, and of stimulating production—which in India may be rendered illimitable if the necessary demand be only created—but they will enable land at present under cultivation, to be cultivated far more perfectly, by the new facilities afforded for the transport of lime, manure, and other materials necessary to agricultural improvement. Lime is one of the necessities of agricultural life; and it may be reckoned that every acre of land requires 6 cwt. of lime, per annum, to keep it in good condition. Supposing the lime to be only from 15 to 20 miles distant, the mere saving in the cost of carriage upon this one article would be equal to 1*s.* 6*d.* per acre per annum; and even in localities not more than from 15 to 20 miles from the port at which the produce was shipped, the saving accomplished by the formation of a railway would be equivalent to not less than 4*s.* per acre, per annum.

In the transport of draining tiles, railways would also prove of material service. The chief benefit must lie in the saving of the cost of current consumption. This is a very important consideration. The line, constructed

should be so led as to afford effectual agricultural accommodation; and many of these branches could be made without iron rails, the wheels, which would require to be rather broader than usual, running merely on the longitudinal wooden sleepers. Such railways would be perfectly effectual, would give vast accommodation, and be very much cheaper than roads. It is desirable, too, that, where practicable, the railway tracks should be made available, as far as possible, for conducting the water required for the supply of towns, or for the purposes of irrigation as well as for the accommodation of the pipes carrying gas into towns, and sewerage water out.

Concurrently with the introduction of railways the government—which is in India the owner of the land—must be prepared to make the railways sufficiently long to induce the investment of capital in agricultural improvements: and it must be arranged, that an allowance shall be made for the cost of the improvements at the time when the railways are opened. With these impediments removed, and with the market for agricultural produce inviting the approach of the railways, it is probable that the government will undertake the construction of railways, and that the railways will advance the progress of agriculture, and that other trades will be advanced.

printed in Mr. Stirling's report on railways, says,—“I think that the railways would soon become a great source of wealth from choice, pious, and other motives. At least there are very few who would not nearly all would take

Operation of
Indian rail-
ways upon
the trade in
grain.

some doubt has been thrown upon this anticipation by the allegation that the grain is liable to heat and become deteriorated in quality, in consequence of having to perform so long a voyage ; but the validity of this objection is disputed, and who, in these days of practical science, can suppose it to be insuperable, even if existent ? It has yet to be ascertained whether the grain would heat if more thoroughly dried, or if carried in iron ships, or if penetrated by perforated air pipes, to give an effectual ventilation. There can be very little doubt that the difficulty can be overcome, if, on further experiment, it is proved to exist ; provided only there be sufficient temptation to make the attempt ; and the amount of this temptation may be judged of from the following official return of the relative prices of grain in India and England in 1845 :—

Comparison of the prices of Wheat, Flour, and Split Peas, in Bengal and Mark Lane.

BENGAL. Averages for July, 1845, for 53 towns.			ENGLAND. Averages, November, 1845, Mark Lane.		
Quantity of Wheat pro- curable for the rupee of 2s.	Quantity of Flour pro- curable for the rupee of 2s.	Quantity of Dhall pro- curable for the rupee of 2s.	Quantity of Wheat pro- curable for the sum of 2s.	Quantity of Flour pro- curable for the sum of 2s.	Quantity of Peas pro- curable for the sum of 2s.
About 62lb.	About 47½lb.	About 57½lb.	About 17lb. at the average market quotation of 57s. per quarter.	About 11lb. at the average market quotation of 52s. for the sack of 280lb.	About 19lb. at the average market quotation of 52s. the quarter.

The average weight of English wheat is 60lb. to the bushel : 8 bushels, or 480lb. to the quarter. The weight and price of the Indian grains are reduced to avoirdupois and English currency.

These loose and general remarks are probably sufficient to show, that the introduction of railways into India would add stability to the government, and greatly stimulate production ; and these results would re-act upon the railways by giving a new activity to commerce. Nor would passengers be wanting, though merchandise must be the chief support of the Indian lines. Independently of the persons travelling for the purposes of business, there are a large number of pilgrims continually proceeding from every part of India to the holy cities of Gyah and Benares, and other sacred spots, which would largely swell the number of passengers proceeding by the railway trains. It has been doubted, indeed, by some persons, whether pilgrims in India would avail themselves of a railway, inasmuch as the act of proceeding on a pilgrimage was supposed to be an act of mortification, which required the devotee to proceed on foot. That a pilgrimage may be regarded in this light by a few persons is probable enough, but that it is generally so regarded is confuted by the fact, that pilgrims almost invariably proceed by some species of conveyance or other whenever they can afford it.

Passenger
traffic on the
East Indian
line.

Mr. Higgenson, in a letter printed in Mr. Stephenson's Report upon Indian railways, says,—“ I think the number of passengers would soon become very great ; no native walks from *choice*, pious pilgrim though he be, at least there are very few who do, and I am confident nearly all would take

Pilgrims
would travel
by railway.

advantage of a very cheap and quick conveyance if it were offered to them." The question, however, being of importance, has been formally submitted to the Dhurma Subha, the highest ecclesiastical authority on such points, and it has been declared by that authority, that it is perfectly permissible for pilgrims to travel by railway. In Mr. Stephenson's Report, (p. 35,) there is an admirable letter given, from Messrs. Kelsall and Ghose, written by Baboo Ram Ghopaul Ghose, which illustrates this question so clearly that we here transcribe some passages from it :—

"The relation between the people and the seat of power and government are by no means unimportant. The government itself, for the conveyance of its mails and troops, would not afford a trifling support. Their servants, to whom time is valuable, would prefer expeditious travelling; the growing class of intelligent natives would freely resort to it; and lastly, the religious connection between the Hindoos and the holy cities of Benares, Gyah, Allahabad, and others, would alone fill the trains with hundreds of the better class of pilgrims. This brings us to consider the extent of religious prejudices. As a native of the land the writer feels some confidence in stating his opinion, that he believes they may be overcome by a few simple arrangements. Let there be three divisions of the people, namely, Mahomedans, and high and low caste Hindoos. If any female passengers offer, let them be accommodated in separate carriages; and

do not let the travellers be required to make a run of more than 12 hours at a time (which of course would never be necessary). We feel sure, with these easily effected arrangements, railway travelling would be generally and eagerly availed of by all classes of men—except, perhaps, by a few—very few—old antiquated Hindoos, who look upon every innovation with feelings of horror. The only serious objection would be on the part of the females; but even this stronghold of native prejudice we hope to see successfully undermined by the civilizing influence of steam.”

Railway arrangements proper for pilgrims.

Baboo Mutty Loll Seal, another intelligent native merchant, says, “If an industrious and thriving population, numbering about 100,000,000,—a large, active, and daily expanding internal traffic—cheap land and labour, with most of the necessary materials for construction on the spot, at prices equally low—and perfect security for person and property, are elements that will command success,—then it is certain that a more promising field than Bengal for the investment of railway capital, could not be found.”

In spite of these favourable judgments, however, doubts have been raised in India as to the applicability of the railway system to that country, inasmuch as in England railways have been chiefly supported by the passenger traffic, which would not be sufficient to support a railway in India, on account of the poverty of the people; and it is judged doubtful whether a railway could be supported

Indian rail-
ways will be
chiefly sup-
ported by
merchandise

chiefly by the transport of merchandise. There is no doubt, however, in the matter, provided only the railway gets merchandise enough to carry. If it is profitable to carry ten tons of goods, it is certainly more profitable to carry ten thousand ; and it is obvious enough, that by increasing the quantity of merchandise sufficiently, the passengers might be eliminated with impunity. It is no doubt the fact, that the people in India are for the most part too poor to pay for expensive travelling. A Bengalee ryot is deemed comfortable if he can afford to live up to 3 rupees a month, though in the Upper Provinces 4 to 5 is the average. Mechanics earn from 5 to 8 rupees a month ; a Sepoy receives 7 ; police peons 5 to 7 ; domestic servants of Europeans 5 to 8 ; and labourers 4 to 5 rupees per month. Whatever be the poverty of the people, however, they need not be prevented from availing themselves of the railway, if it carries them more cheaply than they could proceed on foot ; and this, as will presently appear, it is perfectly able to do, with a profit on the transaction. Taking the lowest cost of subsistence at $1\frac{1}{2}$ anna per day, the cost of a journey by foot from Calcutta to Benares, which will occupy about a month, will, with ferries, tobacco, and other extras, amount to from $3\frac{1}{2}$ to 5 rupees, *without reckoning anything for the time* ; and it would obviously be more profitable, even for a labourer or blacksmith, to pay 6 rupees, or $\frac{1}{3}$ rd of a penny per mile, to be carried in 12 hours to his destination, than to spend 4 or 5

rupees in money, and a month's time, amounting to 4 or 5 more in performing the journey on foot. In England passengers can afford to pay higher fares, and the passengers' traffic is there the chief support of a railway; because the sea offers such facilities for the transport of merchandise that railways cannot compete with it. The prospects of a railway, however, cannot be supposed to be damaged by the absence of such a competitor, and in this predicament the East Indian line stands; for its only competitor is the Ganges, the dangers of navigating which are so great, that the insurance to Mirzapore from Calcutta is greater than it is to England. To say, therefore, that English railways are supported chiefly by their passenger traffic, which cannot be the case in India, is tantamount to saying, that in India railways will have the advantage of the transport of merchandise, of which, from geographical peculiarities the English railways are deprived.

Rates to be charged for passengers, and absence of competition of Sea navigation.

It is necessary, however, before the expenditure of capital in the construction of a line of railway can be justified, that some more precise estimate of its merits should be possessed, than can be afforded by a vague conception of eligibility. It is necessary to see, not only that it will realize profit, but that it will pay a dividend large enough to warrant the prosecution of the undertaking; and this conclusion can only be arrived at after a careful investigation of the extent of the traffic, and of

Necessity of
a more pre-
cise estimate
of profits,
and method
of arriving
thereat.

the existing rates of charge, and by the discovery of the relation which the return thus deduced has to the cost of construction. It may fairly be assumed, that the railway will monopolize the whole of the existing traffic, if it carries at a lower rate than is at present possible, and an increase of traffic may also be anticipated from the new facilities afforded; but it is impossible to reckon this increase in any estimate of profits, without quitting the domain of fact for the region of conjecture, and introducing into the investigation the element of doubt. The amount and cost of the existing traffic on the East Indian line, can be ascertained by an appeal to facts that are unquestioned; the expense to which it is determined to go in the construction of the line, and to which the engineer must be required to adapt his plans, can also be settled; and then the minimum dividend can be ascertained with sufficient accuracy to warrant the confidence of the public. To this investigation we shall now proceed, assuming as our only postulate that the railway, if it carries more cheaply as well as more expeditiously than the existing modes of conveyance, will attract to itself the traffic now carried on in the line of country through which it passes.

CHAPTER II.

TRAFFIC OF THE EAST INDIAN LINE.

THE traffic of the districts lying between Calcutta and the north-west provinces, available for the support of a railway, may be supposed to be made up of—1st., the export and import trade passing through Calcutta; 2nd., the local trade, or trade between different places on the proposed line; and, 3rd., the passenger traffic. It is not very easy to distinguish in every case between the export, and import, and the local trade; but we may arrive at a tolerably near approximation though the distinction is by no means essential.

Export and
Import trade
of Calcutta.

By Wilkinson's Tables of the External Commerce of Bengal, it appears that in the years 1844-5, the export tonnage of vessels proceeding from the port of Calcutta, was 255,323 tons, and the total import tonnage during the same time, was 275,939 tons. It appears, moreover, from the actual quantity of goods on which duty was paid, that the vessels could not to any considerable extent have sailed in ballast, and that they must have carried considerably more than their register tonnage of cargo. Of 57 articles of *export* enumerated, 24 articles, of which the quantities are the most considerable, make up the weight of 62,08,854 maunds, or about 230,000 tons, although there are among

Export and
Import trade
of Calcutta.

the articles unenumerated, as their weight could not be readily ascertained, about 6,000,000 gunny bags, 21,323 pieces of gunny cloth, and 3,127,250 hides. The following are the 24 articles referred to :—

Enumeration of some of the Chief Articles of Export from Calcutta, and the Quantities of each Exported in the years 1844-5.

Opium, 18,793 chests	.	.	say	47,000 maunds.
Indigo	.	.	„	1,29,444 „
Sugar	.	.	„	15,39,117 „
Saltpetre	.	.	„	5,86,976 „
Rice	.	.	„	23,77,565 „
Wheat	.	.	„	1,64,022 „
Grain	.	.	„	59,278 „
Dholl and peas	.	.	„	45,520 „
Flour	.	.	„	12,532 „
Raw cotton	.	.	„	2,01,874 „
Raw silk	.	.	„	22,343 „
Country cotton pieces, about 12,00,000,			„	85,000 „
Castor oil	.	.	„	22,701 „
Ginger	.	.	„	13,970 „
Hemp	.	.	„	12,127 „
Jute	.	.	„	3,52,705 „
Lac dye	.	.	„	22,352 „
Shell lac	.	.	„	42,626 „
Linseed	.	.	„	2,44,785 „
Molasses	.	.	„	35,992 „
Mustard seed	.	.	„	61,671 „
Rum, 6,32,563 gallons	.	.	„	92,448 „
Safflower	.	.	„	11,323 „
Turmeric	.	.	„	35,482 „

62,08,854 maunds.

Or about 230,000 tons.

Adding one third for unenumerated articles, we have for the total exports 306,666 tons. Vessels generally carry one-third more than their register tonnage, so that the register tonnage being 255,323 we shall have a capacity of 340,431 tons for cargo, or room for about 34,000 tons more than were actually carried, which shows that our estimate is not in excess.

Export and
Import trade
of Calcutta.

Of 145 articles imported into Calcutta, the 39 of which the quantities are largest, are as follows:—

Enumeration of some of the chief articles of import into Calcutta, and the quantities of each imported in the years 1844-5.

Alum	say	65,680 maunds.
Betel nut	„	23,764 „
Brimstone	„	23,027 „
Bottles (empty), 2,37,723 dozen	„	17,400 „
Buffalo horns, number 4,82,185	„	11,760 „
Coffee	„	17,270 „
Coke	„	13,028 „
Coal	„	2,64,552 „
Chalk	„	15,981 „
Coral	„	3,37,164 „
Cochineal	„	10,374 „
Coir rope	„	18,238 „
Cheese	„	1,91,331 „
Dates	„	38,533 „
Earthenware 2,33,973 rps. value	„	57,070 „
Haberdashery, &c., 21,04,409 rps. value	„	50,000 „
Hardware 8,47,267 rps. value	„	4,900 „
Hides, about 4,00,000 rps. value	„	80,000 „
Copper (slab)	„	83,176 „
— sheet	„	52,839 „

Export and Import trade of Calcutta.	Spelter	say 1,42,744 maunds.
	Tin	„ 10,441 „
	Lead	„ 53,531 „
	Lead shot	„ 15,018 „
	Iron	„ 5,04,154 „
	Steel	„ 26,226 „
	Paddy	„ 4,92,328 „
	Pepper	„ 50,977 „
	Piece goods, about 60,00,000 pieces .	„ 4,27,800 „
	Ratans	„ 19,615 „
	Rice	„ 66,394 „
	Sandal wood	„ 18,390 „
	Sapan wood	„ 24,554 „
	Salt	„ 9,70,595 „
	Ale and Porter 17,228 hds. .	„ 1,29,420 „
	————— 46,763 dozen .	„ 25,000 „
	Twist and yarn	„ 1,77,800 „
	Woollens 22,64,889 rps. value .	„ 36,000 „
	Sundries 19,15,597 rps. value .	„ 40,000 „
		<hr/>
		46,07,074 maunds.

Or 170,632 tons.

As in the returns of the Customs department, the value or number only, and not the weight of some of the articles enumerated has been given it, has been necessary to reduce these values to their corresponding weights, which has been done, according to the following proportions:—

Hides, 100 rp's. worth	1 ton.
Earthenware, 1 rp's. worth	20 lbs.
Opium, 1 chest	205 lbs.
Bottles, 1 doz.	6 lbs.
Buffalo horn	2 lbs.
Rum, 1 gall.	12 lbs.

Oil, 1 gall.	11 lbs.	Export and Import trade of Calcutta.
Beer, 1 hhd.	.	.	.	.	5½ cwts.
Hardware, 120 rp's. worth	.	.	.	.	57 lbs.
Piece goods, 100 pieces	.	.	.	.	4 cwt.

Among the unenumerated articles are about 2,000,000 chanks, and £12,000 worth of hams. Adding here again one-third for the 106 unenumerated articles we have 227,509 tons, as the total quantity of goods imported. This, it will be remarked, is 48,439 tons less than the register tonnage, but it probably represents very nearly the quantity of goods entering Calcutta for transmission into the interior, for some of the imports are re-exported, and some of the exports are paid for in money and not in goods. The treasure imported into Calcutta in 1844-5 was of the value of 1,60,57,069 Co's. rps., or about £1,605,706 sterling. The treasure exported was 29,15,434 Co's. rps., or about £291,543 sterling, and the greater part of this treasure passes through Calcutta, towards the Upper Provinces. The total value of the imports, was 6,08,69,229 rps., or £6,086,922; of the exports, 9,60,77,561 rps., or £9,607,756; and of the re-exports 43,24,917 rps., or £432,941, or 1/14th of the imports.

It appears then that the total quantity of merchandise, both import and export, passing through Calcutta, is $306,666 + 227,509 = 534,175$ tons per annum, the register tonnage of the vessels conveying this merchandise being $255,323 + 275,939 = 531,262$ tons per annum. The quantity

Destinations
of the Cal-
cutta im-
ports.

of treasure is 1,89,73,503 rps., or £1,897,350. Of the merchandise thus transported, which amounts in value to about £16,000,000 sterling per annum, a small quantity is consumed in Calcutta, and the districts intervening between it and the sea; but by far the greater part is carried into the heart of the country, either by the road leading towards the north-west provinces, or by the Ganges. The precise amount of imports and exports passing between Calcutta and Mirzapore, is at present very much a matter of conjecture: some persons assert that the quantity is not considerable, but the prevailing impression is, that it is very large. In Mr. Stephenson's report* (p. 28), Mr. Kettlewell says that Mirzapore is "the great mart for Bengal raw cotton, British cotton goods, woollens, metals, and more recently for twist, from or through which the countries to the north, east, and for a considerable distance to the west, are chiefly supplied with goods." He also says, that "to Mirzapore, and through Mirzapore to the north, a large proportion of the metals, probably three-fourths of all the woollens, and at least two-thirds of the aggregate of the cotton goods and yarn imported now pass." At p. 30, Messrs. Allan, Deffell and Co. say "that the vast traffic between this city (Calcutta) and Mirzapore (the great central mart for our imports

* Report upon the practicability and advantages of the introduction of Railways into British India, &c. &c., by R. Macdonald Stephenson, 1844-5.

and exports) would, alone, give an immense and valuable traffic."

Destination
of the Cal-
cutta im-
ports.

At p. 33, Mr. Higginson says, "I cannot doubt the success of a railroad between this place (Mirzapore) and Calcutta: the traffic is very great, and is yearly increasing;" and Baboo Mutty Loll Seal at p. 35 says, "my decided opinion is, that lines connecting our great interior marts with this city (Calcutta), could hardly fail to yield a large return on the original outlay." By an estimate supplied by Mr. Chambers, on behalf of Baboo Mutty Loll Seal, and printed in Mr. Stephenson's Report, (p. 48), it appears that, by enquiries among the chief merchants engaged in the Mirzapore trade, it had been ascertained that *not less* than 10 or 12 lacs of rupees worth of goods imported by sea, were taken every month from Calcutta to Mirzapore only, without reckoning what was carried direct to the places above it.* This is from 120 to 140 lacs worth per annum, carried by the principal merchants; and if half the quantity of imports be supposed to be carried direct to places above Mirzapore, we should have from 180 to 216 lacs worth of imports carried to Mirzapore or places above it—the total imports into Calcutta being but 600 lacs. It is immaterial however, what the import and export trade is supposed to be, as the absolute traffic, whether import and export, or local, is ascertainable. In England, and, indeed, throughout Europe, the local traffic of

* A lack of rupees is £10,000.

Trade of the
Ganges.

a railway is found to be the main support ; and it does not appear probable that the Indian lines will furnish an exception to this general rule, so that the total traffic cannot be measured by the *through* traffic, however great it may be.

In the Report of the Rajmahal Canal Committee, drawn up in 1841 by officers of the government, it is stated at page 25 in reference to the trade upon the Ganges, that in the dry season when two of the Nuddea rivers (which are branches of the Ganges) were only passable for dinghees—the smallest description of country boat—and the third only navigable for the minor class of cargo-boats—the annual collection of toll which is charged at the rate of 1 rupee per 100 maunds, amounted to 150,000 rupees, which gives a tonnage passing through the Nuddea rivers of 1,623 tons per day, or 592,600 per annum. As this, however, is not the total tonnage even in the dry season, and as the tonnage in the dry season is not the average tonnage, the committee consider that if the Rajmahal canal were made, the amount of tonnage passing through it from the Ganges to Calcutta would not fall short of 3,000 tons per day, or 1,095,000 tons per annum.

The results obtained from other sources add weight to these deductions. It appears from the official statement of the collector of tolls at Jungypore, on the Bhagarutty river, that in the years 1844-5, the following boats passed through that branch of the Ganges :

1113 Boats laden with Firewood, Straw, Coals, &c.		Trade of the
tonnage in maunds,	10,68,050	Ganges.
7,311 Boats laden with Grain, Vegetables, Indigo,		
Seed, and Mangoes,	40,29,675	
24,329 Boats laden with Salt, Sugar, Saltpetre,		
Cotton, Indigo, &c.	1,64,00,025	
Total tonnage in maunds, .	2,14,97,750	

or, taking 27 maunds to the ton, the tonnage of the laden cargo boats which passed through the Bhagarutty in 1844-5, was 796,213 tons. Between five and six thousand empty boats also passed during the same time, but they need not be taken into account. It is only during the rains, however, that boats of any size can pass down the Bhagarutty branch of the Ganges : at other times, large boats have to pass through the sinuous rivers of the Sunderbunds, or down the main stream of the Ganges to Commercolly and thence proceed through the creeks of the Sunderbunds to Saugor Island at the mouth of the Hoogly, from whence they pass upwards to Calcutta.

To catch the vessels coming through the rivers of the Sunderbunds, a toll is imposed on the vessels navigating Tolly's Nullah, and the Circular Canal at Calcutta. This toll is charged at the rate of 8 annas or $\frac{1}{2}$ rupee for every 100 maunds of tonnage—boats of less than 100 maunds not being counted ; and in the years 1844-5 it yielded 177,791 rupees, showing that 35,558,200 maunds of tonnage had passed through it, which at the rate of 27 maunds to the ton is 1,316,970 tons, and adding

Trade of the
Ganges.

this to that which passed through the Bhagarutty, we have 2,113,183 tons for the yearly traffic on the Ganges. From this, however, several deductions are to be made. The boats are for the most part without decks, and cannot with safety be laden to the extent of their register tonnage: some of the articles of transport come from places so low down upon the Ganges, that they could not be available to swell the traffic of a railway to Mirzapore, while others it may be supposed come from places which are not on the Ganges at all, though the number of such cannot be considerable. It appears from the statement of M. Larruleta, the toll collector at Jungypore, given in Mr. Stephenson's Second Report* (p. 34), that boats do not carry on the average more than two-thirds of their register tonnage, and two-thirds of 2,113,183 are 1,408,789 tons. Deducting from this one-fourth for the local trade of the Sunderbunds we have 1,056,592 tons per annum as the Ganges traffic, independent of the steamers, or 1,059,294 in all; instead of 1,095,000 tons as estimated by the Rajmahal Canal Committee. The general estimate of the Ganges trade at the present time is 1,200,000 tons, but it will be safer to take the smallest estimate. In the returns from which this estimate is derived, the opium passing down the Ganges from Patna and Benares, and the ammunition, provisions,

* Report of the Managing Director to the Chairman, Deputy Chairman, and Board of Directors of the East Indian Railway Company, London, 1846.

&c., transmitted for the use of the troops are not included, as no toll is exacted for the conveyance of those articles, and there is therefore, no ready means of ascertaining their amount.

Trade of the
Ganges.

It appears from the returns of the Jungypore toll office for the years 1840-1, given in Mr. R. M. Stephenson's Report on Indian railways (p. 71-2), that the number of passengers proceeding from Benares and other places above that city to Calcutta by way of the Ganges and Bhagarutty was 26,428 per annum ; and that the number of passengers proceeding from Calcutta to Benares and other places above that city by the way of the Bhagarutty and Ganges was 31,950, making a total of 58,378 passengers per annum.

This statement agrees very nearly with another return from the same office for the years 1844-5, recited in Mr. Stephenson's Second Report, which shows that in that year the following passenger boats had passed through the Bhagarutty, viz., 17 pinnaces, averaging 2 passengers each ; 28 pinnaces, 5 passengers each ; 137 budgerows, 1½ each ; 103 budgerows, 5 each ; 9 cutters, 1 each ; 195 bawleahs, 1 each ; 149 baggage boats, 3 each ; 10,229 pansways, 5 each ; 583 palwars, 4 each. These numbers will be found to give 55,022 as the total number of passengers, instead of 58,378 as ascertained by direct enumeration. These returns, however, cannot be expected to give all the passengers travelling on the Ganges, as *some* of these passengers in the deeper boats may be expected to have been

Trade of the
Ganges.

conveyed by way of the Sunderbunds: but the number of passengers proceeding in country boats by this route cannot be considerable, and as we have no official return of the number, the allowance to be made for them must be a very small one. Bearing in mind, however, the probable increase between 1840 and 1845 upon the general Ganges traffic, as well as reckoning the number of passengers who proceed from the Ganges to Calcutta in country boats otherwise than through the Bhagarutty, we shall be within the truth if we take the number of passengers between Benares, or Mirzapore and Calcutta who travel by the Ganges as 60,000 in 1845, instead of 58,371 as ascertained by the toll collector on the Bhagarutty, to have passed through that river alone in 1840-1.

It appears from a statement of the quantity of freight and passengers carried in the government iron steamers plying on the Ganges between Calcutta and Allahabad, given in Mr. Stephenson's Report on Indian railways (p. 63), that in 1840-1 those vessels carried *upwards* to places on the Ganges of which none were lower than Patna, 57,160 cubic feet of cargo, besides 393,179 pounds weight. The treasure carried upwards during the same period amounted to 11,034,198 rps. or £1,103,419, and downwards to 800,375 rps. or £80,037. The passengers carried upwards were 302, and downwards 151. A subsequent return for the years 1844-5, printed in Mr. Stephenson's Second Report (p. 37), shows a great increase. In that year 7 vessels per-

formed 39 trips upwards to Allahabad, carrying 1,673 passengers, 112,765 measurement feet of cargo, 1,156,909 lbs. weight of cargo, and 17,588,855 rupees, or £1,758,885 in specie. The return voyages were not nearly so productive. About half the number of passengers appear to have been carried downwards by the steamers that were carried upwards, and less than half the cargo and specie. The number of downward trips made in the year and the total revenue from them is not given in the return from which we have quoted ; but the number of downward trips must of course have been about the same as the number of upward trips ; and from the returns of several downward trips which are given, the proportion of goods and passengers carried downwards appears to be what we stated. Taking the downward goods and passengers at one-third of the upward goods and passengers, we have 2,231 for the total passengers ; 150,353 for the total feet of goods, and 1,542,545 for the total lbs. weight of such goods as are estimated by weight, as the returns of the traffic maintained by the steamers on the Ganges. A cubic foot of goods is reckoned as weighing 30 lbs. The total weight of the goods conveyed in the steamers will therefore be 2,702 tons 6 cwt. An examination of the destinations of the different articles of cargo shows that they nearly all proceed to Allahabad, or to places above it : we shall therefore reckon them all as being available for the support of a railway between Calcutta and Mirzapore.

Trade of the
Ganges.

Traffic on
the Mirza-
pore Road.

These developments give us the aggregate trade upon the Ganges; we have next to ascertain what is the average amount of traffic upon the Mirzapore road. That road passes through Burdwan, from whence 20,000,000 maunds, or 74,064 tons of coal, are carried yearly to Calcutta. The coal, however, is not carried by the road, but proceeds down the Damooda river, which empties itself into the Hoogly, many miles below Calcutta. Of the traffic by the road, it appears to be difficult to form a precise estimate, but all accounts concur in representing it as being very great. The 'Englishman' Calcutta paper states that "there is a greater traffic upon the Mirzapore road than upon any road in Europe;" and the following extract from the Bengal and Agra Gazetteer for 1842 (p. 421), seems to bear out that assertion:—"The chief roads of the Burdwan district are from Burdwan to Soory (Beerbhoom) by Koyrapore, Gobindpore, Soopore, Soorool, &c.; from Burdwan to Culna, and from Burdwan to Cutwa. These roads are in very bad repair; but an amazing deal of traffic is carried on by them, especially by the Culna road, which is at times partially repaired by the Rajah. Besides these, one runs from Burdwan to Midnapore, and one from Burdwan to Bancoorah; this last road was at one time to have been a portion of the great trunk road, but that intention was afterwards given up, and the present road made. The great trunk road passess from Hoogly through Burdwan. In the western parts of this

district there are fine cunkry materials for roads. The line of road westward is highly spoken of, and is certainly the best in Bengal. Traffic on
the Mirza-
pore Road

“The soil in Burdwan is not adapted for roads, and between Burdwan and Hoogly the road is further liable to be broken up by the Damooda, when any breaches in its embankments below Burdwan take place. No road in India is probably more frequented than this portion: not only is it the commencement of the great road to the Upper Provinces, but it may be said to be the chief outlet of all the articles of commerce, not only of Burdwan, but of Beerbhoom, Bancoorah, and the jungly districts beyond them. As there is no other metalling for this road but coah or gooten, a species of calcareous nodule, the metalling is rubbed to dust from the great thoroughfare of carts, as soon as laid down; and during the dry weather, the road is consequently deep in dust, and in the rains is in many places a perfect quagmire, in spite of all the care and expense continually incurred.”

By some statistics of the traffic on the road leading through Burdwan, given in Mr. Stephenson's Report, (p. 65), and supplied by one of the government collectors, it appears that the yearly traffic may be taken as 73,000 foot passengers, 7,360 hackeries, 3,650 laden bullocks, 730 private palankeens, and 335 public dawks. About ten days before and ten days after the Doorga Pooja holidays, about 300 persons and 30 palkies daily travel the road,—say 1,000 persons per annum;

Traffic on
the Mirza-
pore Road.

and in December and January, one, two, or three gangs of 50, 100, and 150 pilgrims also pass daily. This statement of the number of foot passengers varies so largely from that given in an official return by Mr. Thompson, of the number of persons passing over the Annabad bridge in 1837-8, as to make it probable that 730,000 is meant instead of 73,000 per annum. The number of foot passengers passing over the Annabad bridge in 11 months was found to be 435,242, and of passengers proceeding in conveyances of various kinds 33,176, making a total of 468,418 in the 11 months, or 507,453 per annum ; and this number may be supposed to have increased considerably in the 10 years which have since elapsed. The number of hackeries specified appears from other data to be near the truth.

A hackery load is 12 maunds, but as the whole number of hackeries would not probably be fully laden, we may take the load of 10 maunds for each, which gives 73,600 maunds, as the weight carried per annum by hackeries ; and as 12 bullocks will carry about a ton, we have 304 tons of merchandise annually carried by the bullocks. Besides this, however, we have 500,000 maunds of sugar and goor ; 350,000 maunds of salt ; 10,000 rupees worth, or say 1,000 maunds of cotton ; and 100,000 rupees worth, or say 50,000 maunds of rice, and other miscellaneous articles. A good deal of grain comes down the Damooda, following the same route as the coals ; and grain from Sherghur also

descends the Damooda, and salt and cocoa-nuts in considerable quantities are carried up both the Damooda and Adjye; but we have no means of estimating the extent of this trade, and cannot therefore reckon it.

Traffic on
the Mirza-
pore Road.

The greater proportion of the merchandise passing through Burdwan is carried to places far beyond it, and most of the merchandise proceeding upwards to Cawnpore is now transported by the road. The Bengal and Agra Gazetteer states—"Since the opening of the New Burdwan, or Mirzapore road, a curious change has been made in the carriage or conveyance of one branch of the internal commerce of this country. The Moguls and other merchants who carried woollen cloths, piece goods, and other less bulky and lighter articles to the Upper Provinces, have in a great measure given up the more tedious voyage by the river, and now take their goods to Benares and Cawnpore by carts. The greater expense by this mode,—a cart costing about 50 rupees from Burdwan to Benares, and 60 more rupees to Cawnpore, is more than made up by the time saved. The carts go in 1½ months, while 4 and 6 months were consumed on the voyage by boats."

This statement of the large transmission by carts of the merchandise intended for the Upper Provinces, is confirmed by various authorities cited in Mr. Stephenson's Report, and is moreover known by every person acquainted with India to be a just representation of the fact. The circumstance goes

Traffic on
the Mirza-
pore Road.

to show that much of the traffic passing through Burdwan is not local traffic, and we shall probably not err widely if we consider the traffic existing on the Burdwan road, as extending in undiminished quantity all the way to Mirzapore. The Raneegunge collieries are situated about as far beyond Burdwan as Burdwan is from Calcutta, and the Annabad bridge, over which so large a traffic has been shown to exist, is not far from Benares. Most of the salt entering Burdwan from Hoogly, and the places adjacent, passes on to Behar and the districts beyond it. All the pilgrims travelling on the road pass as far as Gyah or Benares, and as the road approaches Benares, which is only 28 miles in a direct line from Mirzapore, a large accession of pilgrims from the intervening and circumadjacent districts fall in to swell the general stream. To these must be added the pilgrims to Birjonauth, Deogurh, and other places, and carriers of Ganges water, for the service of the numerous temples in the southern provinces.

These water carriers, who travel in large troops, use only the upper end of the road, and branch off at various points between the Saone and Burdwan ; so that the road, though it loses some of its traffic at Burdwan, gains other traffic which compensates for the loss. The railway will pass through or beside the districts of Beerbhoom, Ramghur, Palamow, Behar, and Monghyr, in parts of which there is a good deal of jungle and uncultivated land, and the direct line to Mirzapore has been objected to

on that account ; yet, although there is neither the same productiveness nor activity of commerce which distinguishes the valley of the Ganges, there is nevertheless a large amount of intercourse, and all the elements necessary to increase it.

Traffic on
the Mirza-
pore Road.

The valley of the Damooda is rich in villages, and is without jungle from Burdwan to its sources. Chota Nagpore is so populous that there is every year an emigration of the inhabitants into the plains to find subsistence, and there cannot be a doubt that these industrious people would settle in the jungle districts, and speedily reclaim them, provided the operation could be made profitable by affording an outlet for their produce.* Iron is mined and worked by the natives at Belliah, 30 miles above Ramghur, and is sold for the use of the surrounding districts at the rate of 3 rupees per maund. Lead mines have been discovered in Ramghur, and coal exists in great abundance in Palamow and Behar. Palamow, it is believed, does not raise grain enough for its own consumption, and has to import grain from Shahabad and other districts, sending in return its own productions.

The districts of Sirgoojah, Palamow, and Chota Nagpore carry on a considerable traffic with the great marts upon the Ganges, and all these contributions of local trade would go to swell the traffic of a railway ; so that, although the railway dropped

* The charge for clearing a beegah, or 16,000 square yards of jungle in this district, and taking out the roots, is 8 rupees, or 16s. sterling.

Traffic between Calcutta and Mirzapore.

at Burdwan the trade pertaining to that locality, it would gather a new local traffic as it proceeded further on. The outline of the country to be accommodated by the railway is triangular, of which Calcutta forms the apex, and the area of feeding surface expands into a greater breadth as the line advances towards the north. Taking, then, the number of travellers ascertained to pass over the Annabad bridge as the mean passenger traffic, and the merchandise passing from Burdwan to Calcutta as the merchandise traffic available for a railway, we have of passengers 507,453 per annum ; and of merchandise, reckoning 27 maunds to the ton, 106,754 tons per annum.

With these developments, it becomes easy to determine the total amount of traffic at present subsisting between Calcutta and Mirzapore, which will be as follows :—

Traffic per annum reckoned both ways between Calcutta and Mirzapore,

Merchandise.

Carried by the river in native boats	.	1,056,592 tons.
Carried by the river in steamers	.	2,702 „
Carried by the road and Damooda	.	106,754 „
Total number of tons		<u>1,166,048</u>

Passengers.

Carried by the Ganges in native boats	.	60,000
Carried by Ganges' steamers	.	2,231
Travellers by the road	.	507,453
Total number of Passengers		<u>560,684</u>

At page 70 of Mr. Stephenson's Report on Indian Railways the following return is given by J. Weller, Lieutenant Engineer, late superintendent of the Allahabad and Cawnpore road :—

Traffic on
the Allaha-
bad and
Cawnpore
Road.

Registry of traffic at four stations on the Allahabad and Cawnpore road, from the 1st to the 31st of January, 1841, inclusive.

Transport.

		Daily average at each point of the road.
Hackeries . . .	11,959	964
Camels . . .	4,649	375
Bullocks, &c. . .	14,504	117
Coolies . . .	7,080	114

Travelling.

Carriages . . .	3,159	33
Palkees . . .	653	52
Dhoolies . . .	479	77
Elephants . . .	441	35
Camels . . .	226	36
Horses . . .	12,972	104
Foot passengers at one station	29,562	953

The second column of figures in this table is manifestly erroneous, as it is not consistent with the first one ; the error arises chiefly from the omission of the decimal point, but there are also some mistakes of arithmetic. The first column represents the total number of hackeries, &c., passing four points of the road in 31 days ; and the second column, which represents the daily average, should, therefore, be $\frac{1}{31}$ th of the first line. The numbers in the

Traffic between Mirzapore and Delhi.

second column should be, 96.4 ; 37.5 ; 117 ; 57 ; 25.6 ; 5.2 ; 3.8 ; 3.5 ; 1.7 , 108 ; and 953. The carriages used in the Upper Provinces are a species of omnibus, and reckoning each of these to carry 6 passengers, and all the other conveyances to carry 1 person each, we have 56,804 travellers per annum by carriages ; 1,959 by palkees ; 1,437 by dhoolies ; 1,323 by elephants ; 668 by camels ; 38,916 by horses ; and 334,744 passengers on foot, making a total of 446,851 travellers, per annum, by the road.

Reckoning a hackery to carry 10 maunds, a coolie to carry 100 lbs., and 6 camels, or 12 bullocks, to carry a ton, we have, for the total quantity carried in hackeries, 13,285 tons ; on camels, 2,324 tons ; on bullocks, 3,626 tons ; and by coolies, 948 tons, making a total of 20,183 tons carried by the road per annum.

This, however, does not by any means represent the total traffic of the district that would be available for a railway. At Allahabad the Ganges divides into two great streams, the Upper Ganges and the Jumna, which proceed in a nearly parallel direction, through the district the railway would traverse—the Ganges passing through Cawnpore, Ferruckabad, and Hurdwar ; while the Jumna passes through Humeerpur, Agra, Muttra, and Delhi. The road traverses the district between the two rivers from Allahabad, through Cawnpore, Mynpooree, Allyghur, and Meerut, on to Suharunpoor ; between which and Delhi there is a canal

called the Doab Canal, which, although only newly opened, passing through a district *above* Delhi of only subordinate importance, and running parallel for the whole length of its course with the Jumna, realizes, after paying all expenses, between 8 and 9 per cent. on the money invested, as appears by page 28 of the Supplement to Mr. Stephenson's Second Report.

Traffic between Mirzapore and Delhi.

There does not appear to be any statistical returns whereby the amount of traffic on the Upper Ganges and the Jumna can be specifically determined; the shoals and rocks present impediments to the navigation which must make the traffic much less than that of the Lower Ganges; nevertheless, as there are official returns to show that the traffic of the districts through which those rivers flow is very great, and as this large amount of traffic does not appear in the road returns, it must be carried on by water; so that, by deducting the road traffic from the total traffic, as ascertained by official returns, an approximation to the river traffic may be arrived at. At page 39 of Mr. Stephenson's Second Report, Major Munro, late of the Bengal Army, makes the following estimate of some of the elements of the traffic that would be available for the support of a railway in the north-west provinces :—

“After comparing the various estimates which have been made as to the amount of sugar imported into Calcutta from the Upper Provinces, I am inclined to fix the medium at 100,000 tons; some

Traffic between Mirzapore and Delhi.

estimates exceed, and others fall short of that amount; in the article of cotton, also, the various estimates show a like discrepancy, but the medium may be taken at 50,000 tons. We have better data to enable us to form an accurate estimate as to the amount of salt exported to the Upper Provinces, and we cannot err if we adhere to the returns of salt put up at the public sales of government. We may, therefore, safely fix the amount manufactured and brought for sale at 50 lacs of maunds, which, at the rate of 20 maunds to the ton, gives the enormous amount of 200,000 tons of salt; from this, however, we must deduct what is consumed in the Lower Provinces, and, computing that consumption at 75,000 tons, we have still 125,000 tons for exportation to the Upper Provinces; and, if the government should decide on forming depôts for the sale of salt at different large cities and towns under the superintendence of the collector—as suggested long ago by a distinguished member of the Court of Directors—there is every probability that the whole of the salt so exported will be despatched by rail.”

This estimate gives 275,000 tons of salt, sugar, and cotton, as at present carried between Calcutta and the Upper Provinces; and as the road returns gives only about 20,000 tons of merchandise, of every kind, as carried by land, it is clear, if this estimate is to be accepted, that the great bulk of the traffic must be carried on by water. By a return of the Jungypore toll office, given in Mr. Ste-

phenon's Report (p. 71-2), it appears that the total amount of goods passing that toll to or from Benares, or places above it, in 1840-1, was 178,866 tons, which may be taken at about one fourth of the total quantity passing the toll altogether; so that, of the total traffic of the Lower Ganges, about one-fourth, or 264,823 tons, may be reckoned as *through* traffic from Calcutta to Benares, and places higher up. If, then, this quantity of merchandise proceeds to or past Benares, it is very certain that the amount of local traffic must many times exceed that amount, even in the case of articles which form the staple exports of the country. If 100,000 tons of sugar proceed from the Upper Provinces towards Calcutta, more than half must be consumed by the way; for the total quantity of sugar exported from Calcutta was, in 1844-5, only 57,004 tons, showing that there must be a large local consumption, and a large local traffic to satisfy it.

Traffic between Mirzapore and Delhi.

On the English railways the amount of *through* traffic is so small in comparison to the local traffic, that the average distance travelled by 1st class passengers is only 26½ miles; and the average distance that 2nd class passengers travel is only 13½ miles—a proportion which, if applied to the traffic between Calcutta and Benares, would make the local traffic from 17 to 34 times greater than the through traffic. But as the average distance travelled appears to increase with the length of the line, the proportion which obtains in England will not

Traffic between Mirzapore and Delhi.

apply to a line 1,000 miles in length, though there is no doubt that in every country the local, or short traffic, must be the chief support of a railway. If, then, it appears that any large quantity of merchandise is carried from the north-west provinces to Calcutta, it is certain enough that there must be a much larger quantity circulating to and fro in the districts intervening ; and if, in the districts above Mirzapore, the *through* traffic be as great as is asserted, it is certain that the total traffic must be very large, as the local traffic will be still more important. It is necessary, however, to proceed to a more specific method of determination.

It appears by a return printed in Mr. Stephenson's Report (p. 72), that the sugars which passed the customs line of the north-west provinces in 1841, was 22 lacs of maunds ; in 1842, the quantity was 34 lacs of maunds ; and if the increase be supposed to have gone on in the same ratio, the quantity would have been, in 1845, about 57 lacs of maunds ; but, say that the quantity was 38 lacs of maunds in 1845. By a table showing the amount of duty paid at the four stations of Kurnaul, Delhi, Hodul, and Agra, in the north-west provinces, in 1845, printed in Mr. Stephenson's Second Report (p. 26), it appears that the quantity of salt passing those stations in that year, was 17,00,811 maunds ; of cotton 2,67,871 maunds ; and of sugar 11,56,927 maunds ; or, in round numbers, 17 lacs of maunds of salt, 2½ of cotton, and 11 of sugar ;

so that the quantities of salt, cotton, and sugar transported in those districts may be assumed to be on the average in these proportions. If this be so, and there were in 1845 about 38 lacs of sugar carried in the whole district, there must have been 8 lacs of cotton and 59 lacs of salt, or in all 105 lacs of those articles. By the return of Bhagarutty tolls, printed in Mr. Stephenson's Second Report (p. 34), it appears, that of the total number of 214 lacs of maunds of merchandise carried by the boats on that branch of the Ganges in 1844-5, only 79 lacs were salt, sugar, and cotton; so that the carriage of 79 lacs of maunds of salt, sugar and cotton, seems to represent the carriage of 214 lacs of maunds of the general merchandise of the country. As the trade above and below Allahabad is very much alike, we are warranted in extending this analogy to the traffic subsisting between Mirzapore and Delhi; and the transit of 105 lacs of maunds of salt, sugar, and cotton must be regarded therefore as representative of the transit of 284 lacs of maunds of the general merchandise of the place. 284 lacs of maunds are 1,051,881 tons. This result differs somewhat from that involved in the statement of Major Monro; for if the total quantity of salt, sugar, and cotton proceeding between Calcutta and the Upper Provinces be 275,000 tons, the total quantity of merchandise, being in the proportion of 214 to 79, or 2.7 times that of the salt, sugar, and cotton, will be 742,500 tons. The difference is explicable on the suppo-

Traffic between Mirzapore and Delhi.

Traffic be-
tween Mir-
zapore and
Delhi.

sition that, in Major Monro's return, he has neglected some of the local traffic; and from the terms of his estimate, which speaks of the traffic as between the north-west provinces and Calcutta, this appears to be the case. The larger estimate, in addition to being the best supported, agrees most nearly with the conjecture, that the traffic above Mirzapore would be found to be very much the same as the traffic below it—a coincidence which many considerations render probable. To leave no room for doubt, however, we shall take the mean of the two quantities, which is 897,190 tons. With these determinations, the traffic between Mirzapore and Delhi, available for the support of a railway, will stand thus :—

*Traffic per annum, reckoned both ways, between
Mirzapore and Delhi.*

Merchandise.

Carried by river and road, export, import, and local 879,190 tons.

Passengers.

Total passengers by the road . . . 446,851

Having now ascertained the amount of traffic, it only remains to determine its cost, whether carried on by the river or by the road.

Cost of Transport by Road.

The expense of conveyance by land is equal to
between 3*d.* and 4*d.* per ton per mile.

Cost per ton
per mile.

3*d.* to 4*d.*

G. ASHBURNER.

A hackery and two bullocks, carrying 12 maunds for a distance of 40 miles, costs 2 rps. 8 as. The rate of travelling is from 12 to 14 miles a day. The journey between Burdwan and Calcutta, a distance of 70 miles, occupies between 4 and 5 days.

J. SHAW.

[This is 40 annas for 40 miles, or an anna a mile for 12 maunds, which is about $3\frac{1}{2}d.$ per ton per mile.]

Cost per ton
per mile.

Present cost
of transport.

$3\frac{1}{2}d.$

A hackery for 40 miles, carrying 12 maunds, costs 3-rupees.

Collector in Stephenson's Report, p. 66.

[This is 12 maunds, carried 40 miles for 72d., or 1 mile for 1.8d., which is 4d. per ton per mile.]

4d.

The contract price paid by the Erskines for the transportation of sugar from Soonamooke to Hoogly, a distance of 90 miles, is 4 rupees 12 annas, for a cart load of 12 maunds.

Collector in Stephenson's Report, p. 67.

[This is 76 annas, or 114d. for carrying 12 maunds, 90 miles, or 1.26 of a penny for carrying 12 maunds 1 mile, which is 2.86, or very nearly 3d. per ton per mile.]

3d.

From Calcutta to Mirzapore, a hackery carrying 12 maunds costs from 35 to 40 rps., besides 8 rps. for a chaprassie.

M. RUSTOMJEE.

[12 maunds carried 450 miles for 40 rupees, or 960d. is 2.13d. for 12 maunds carried 1 mile, or 4.8 equal to $4\frac{1}{2}d.$ per ton per mile.]

$4\frac{1}{2}d.$

Present cost
of transport.

From Calcutta to Mirzapore, the cost of conveying a hackery load or 12 maunds is 36s., which is about 1s. per maund.

J. B. HIGGINSON.

[This is 432d. for conveying 12 maunds 450 miles, or 0.96th of a penny for conveying 12 maunds 1 mile, which is 2.179, or rather more than 2d. per ton per mile.]

Cost per ton
per mile.

2d.

The cost of carrying stone from the quarries at Roopbass to Agra, a distance of 33 miles, is on an average 20 rps.; to Muttra, a distance of 36 miles, 17 rps.; to Bindrabun, distance 41 miles, 15 rps.; but the prices vary with the scarcity or plenty of carriage. There are a greater number of return carts passing to Muttra and Bindrabun than to Agra, and the road is harder and better: this accounts for the cost being less for the larger distances.

J. H. ROBINSON.

[This is 100 maunds, carried 110 miles for 52 rps. Taking 82 lbs. to the maund, 100 maunds is 3.66 tons, and 1 ton would therefore be conveyed through the 110 miles for about 14 rps. or 336d., or 3d. per ton per mile.]

3d.

Average cost of transport by road.....3½d. per ton per mile.

Cost of transport by river in native boats.

The expense of the river route, including insurance and interest during the time occupied in transit, amounts to about 2d. per ton per mile on goods of the value of £40 per ton.

G. ASHBURNER.

2d., with
interest
and in-
surance.

The distance to Mirzapore from Calcutta is 460 miles by Dawk, and at the same rate, the cost of conveyance may be taken on the maund of $\frac{1}{30}$ th of a ton at ten annas, a sum that many persons would prefer paying, to avoid the risks of river navigation, as at present conducted.

GILLANDERS, ARBUTHNOT, & Co.

[$\frac{1}{30}$ th of a ton for 10 annas is 1 ton for 300 annas, or 450d., and the distance of Mirzapore from Calcutta in the line the railway would follow being 450, instead of 460 miles, the cost of conveyance at the rate stated is 1d. per ton per mile.]

Cost per ton
per mile.

Present cost
of transport.

1d.

The expense of carrying goods from Calcutta to Mirzapore by river is not less than from $3\frac{1}{2}$ to 4 per cent. on the invoice price.

R. J. CHAMBERS.

[4 per cent. on goods of £40 a ton is 32s., or 382d. for conveying a ton 450 miles, which is equivalent to 0.85 of a penny per ton per mile. It would appear from comparing this result with Mr. Ashburner's statement, that the insurance upon goods and the interest, are together more than the freight.]

0.85d.

The cost of conveying coals from the collieries at Raneegunge to Calcutta is 10 rps. per 100 maunds.

DWARKANAATH TAGORE.

[The Raneegunge collieries are about 100 miles from Calcutta, which gives $\frac{1}{10}$ th of a rupee for conveying 100 maunds 1 mile, or 2.4d. for carrying 3.66 tons 1 mile, or 0.66 of 1d. per ton per mile.]

0.66d.

Present cost of transport.	The expense of conveying pieces goods from Calcutta to Mirzapore by water is 150 rps. for 250 maunds, and the time required is from six weeks to two months.	Cost per ton per mile.
	M. RUSTOMJEE.	0.88d.
	[250 maunds of 82 lbs. are 9.1 tons, which are carried 450 miles for 3,600 pence, or 1 mile for 8d., which is 0.88 of a penny per ton per mile.]	
	The expense of conveyance down the river from Mirzapore to Calcutta for cotton and other produce is from 1 rupee 4 annas to 1 rupee 8 annas per bale of four Calcutta maunds.	
	M. RUSTOMJEE.	0.54d.
	[1 rupee 8 annas for 4 maunds is 36 pence for 321 lbs. carried 450 miles, or since 328 lbs. is contained 6.8 times in a ton, it is 6.8 times 36 pence, or 224.8 pence for carrying a ton 450 miles, which is 0.54 of a penny per ton per mile.]	
	The present cost of carriage down the river from Mirzapore to Calcutta, inclusive of insurance, is one shilling per maund, and the time occupied is nearly three months.	
	J. B. HIGGINSON.	0.72d.
	[This is 27 shillings a ton for 450 miles or, 0.72 of a penny per ton per mile.]	

The whole of these quantities are not directly comparable, as the expense of conveying merchandise down the river with the stream is not so great as that of carrying it up against the stream; and in the price of carrying goods down the river given by Mr. Higginson insurance is included, which

does not appear to be the case in the second statement of M. Rustomjee, in which the goods are also supposed to be carried downward. Taking the second, third, and fifth statements, in which the goods are supposed to be carried upwards, and which exclude the considerations of interest and insurance, it appears that the cost of carrying goods up the Ganges from Calcutta to Mirzapore is $0.91d.$ or very nearly $1d.$ per ton per mile; while the cost of carrying the goods downwards is $0.54d.$, or little more than $\frac{1}{2}d.$ per ton per mile: or with insurance it is $0.72d.$, or nearly $\frac{3}{4}d.$ per ton per mile. Taking the cost of transport at $\frac{1}{2}d.$, and the insurance at $\frac{1}{4}d.$ per ton per mile, and reckoning that the interest of money is 10 per cent., the value of the goods £40 per ton, and the length of time occupied in the transport between two and three months, we shall have to add $0.43d.$ per ton per mile for interest, which makes the cost of the carriage downwards $1.15d.$, or rather more than $1d.$; the cost of the carriage upwards $1.59d.$, and the average $1.37d.$, or very nearly $1\frac{1}{2}d.$ per ton per mile.

Present cost
of transport.

We have excluded from this comparison the statement of Dwarkanauth Tagore, as the coal he refers to is carried, not down the Ganges, but down the Damooda by a circuitous route, which adds to the expense; and this datum, therefore, if admitted, would make the cost of water transport appear to be greater than it really is. It is clear from the tenor of our remarks, that, in estimating the cost per ton per mile, we have not reckoned the

Present cost
of transport.

distance by following the sinuosities of the river, but by taking the actual distance between the termini in the direction a railway would follow, as it is by this course alone that the cost of river and railway transport become measurable by one another.

Ganges traffic by native boats.

Cost per ton
per mile.

Average cost per ton per mile <i>upwards</i> , including interest and insurance.	} 1.59d.
Average cost per ton per mile <i>downwards</i> , including interest and insurance	

Cost of Transport by the River in Steam Vessels.

The average rate of freight charged by steamer from Calcutta to Allahabad is 2 rps. 10 annas 10 pp. per cubic foot, or for heavy articles 1 anna per lb. weight; freight brought downwards is charged 8 annas per cubic foot, and 1 anna per 3 lbs. weight—a cubic foot weighing 30 lb. on the average. Treasure to Dinapore pays 6 annas per cent., to Benares 8, to Mirzapore 10, and to Allahabad 12 annas. Native merchants are the principal shippers; they fully appreciate the saving of time and insurance, &c. The average voyage to Allahabad is 25 days.

Capt. JOHNSTONE, Comptroller of Steam Vessels.

[2 rps. 10 annas 10 pice, or say 43 annas or 64d. for carrying 30 lbs. 500 miles; or 15,000 lbs., or 6.7 tons 1 mile is 9½d. per ton per mile. 1 anna per lb. weight is 2,240 annas, or 3,360d. per ton for 500 miles, or 6.7d. per ton per mile. The freight downwards is 1.78d. per ton per mile, or only about ¼th of that upwards on the measurement goods, and ⅓rd of that upwards on the heavy goods, or 2.2d. per ton

Average
upwards
4d. per
ton per
mile;
average
down-
wards 1d.
per ton
per mile.

	Cost per ton per mile.	Present cost of transport.
per mile. Average <i>upwards</i> 8 <i>d.</i> per ton per mile; average <i>downwards</i> 2 <i>d.</i> per ton per mile. Since the time Capt. Johnstone's information was given, however, the cost of transport has been reduced about one-half; so that 4 <i>d.</i> per ton per mile for the upward, and 1 <i>d.</i> per ton per mile for the downward voyage will now be about the right proportions.]	Average <i>upwards</i> 4 <i>d.</i> per ton per mile; average <i>downwards</i> 1 <i>d.</i> per ton per mile.	

Passengers.

Cost of each Passenger per mile

1st Class.—The expense of the journey by land from Calcutta to Benares with 12 bearers, is from 150 to 200 rps.; a palanquin will cost 125 rps., besides 25 rps. for a banghy to carry provisions. By water the cost is 180 to 200 rps.

M. RUSTOMJEE.

8*d.*

[Taking the cost at 150 rps. and the distance at 450 miles, though in reality it is but 428 miles by the road, the cost per mile will be 8*d.*]

2nd Class.—By buying a horse and selling him at the end of the journey, the cost of proceeding from Calcutta to Benares on horseback will be 23 rps. The hire of an eka that will carry two persons is 30 rps. and the hire of a rutha that will carry 4 persons is 60 rps., or 15 rps. each person; but the charge for crossing rivers, &c. amounts to 8 rps. in addition.

RAM COOMUL SIN.

1.12*d.*

[23 rps. or 554 pence spent in 450 miles is 1.23 of a penny per mile. 19 rps., which is the half of 38, or 456 pence spent in 450 miles is about one penny a mile. The average is 1.12 of a penny per mile for each passenger.]

Passengers.

Cost of each Passenger per mile.

Present cost of transport.

3rd Class.—A boat of six oars capable of taking from 6 to 10 persons, costs for the passage from Calcutta to Benares, 60 rps. The toll is 3 rupees and the sums paid to Chokeydars to prevent detention, &c. is about 12 rps., or 75 rps. in all exclusive of provisions for 6 to 10 persons. The expenses of a journey on foot are not so easily determinable, but the allowance for the journey among the natives, when a messenger is sent on foot, is 10 rps., which includes wages, food, and all charges.

RAM COOMUL SIN.

[75 rps. for 10 persons is $7\frac{1}{2}$ rps. for each, or 180 pence for 450 miles, which is 0.4 of a penny for each person per mile. 10 rps. or 240 pence for 450 miles is 0.533 of a penny per mile. The voyage by boats occupies from 30 to 45 days, say 38 days, and the most parsimonious Hindo cannot subsist himself for less than $1\frac{1}{2}$ anna per day for fuel, flour, or rice, ghee and salt, this is 85 pence for 36 days, or 0.2 per mile; so that the cost of conveyance by water including subsistence, appears to be 0.6 of a penny per mile for each person.]

By boat .6 of a penny including subsistence. By foot 0.533 of a penny including time and subsistence.

CHAPTER III.

PROFITS OF THE EAST INDIAN LINE.

HAVING now ascertained the amount of traffic *at present existing* in the districts traversed by the East Indian line, and the average cost of transport by the existing modes of conveyance, it only remains that we should determine what amount of dividend this traffic, if secured to the railway by moderate charges, would return upon the capital invested. Before proceeding to this determination we may, for the sake of distinctness, briefly recapitulate the chief facts at which we have arrived.

Recapitulation of extent and cost of traffic.

On the line between Calcutta and Mirzapore the total quantity of goods carried is 1,166,048 tons per annum, and the total number of passengers per annum is 569,684. On the line between Mirzapore and Delhi the goods traffic is 897,190 tons per annum, and the number of passengers per annum is 446,851. The average cost of carrying goods by the road is $3\frac{1}{4}d.$ per ton per mile. By the river the average cost upwards in native boats is, including interest and insurance, $1.59d.$ per ton per mile : and downwards, $1.15d.$ per ton per mile, making an average of $1.37d.$; the charges by the steamers are so much above this—being $4d.$ per ton

Rate of
charge ob-
tainable by
the railway.

per mile upwards, and $1d.$ per ton per mile downwards, exclusive of interest or insurance, or on the average of $2\frac{1}{4}d.$ per ton per mile, exclusive of interest and insurance, that they need hardly be considered. The average cost of travelling is, to 1st class passengers, $8d.$ per mile each; to 2nd class, $1.12d.$ per mile each; and to 3rd class, $0.6d.$ per mile each, including food if proceeding by water, and $0.533d.$ per mile each, including time and food if travelling by foot.

With these rates of charge for the present unsatisfactory modes of conveyance, it may be supposed that an average charge of $1d.$ per ton per mile for goods carried by the railway, and $\frac{1}{4}d.$ per mile each for passengers, would be sufficient to attract to it the whole of the existing traffic. These rates, moreover, would make a large dividend permissible, provided it could be realized. The average rates of charge on the London and Birmingham Railway for goods is $1.8d.$ per ton per mile, and for passengers $1\frac{1}{4}d.$ each per mile; these rates are about twice greater than those proposed for the East Indian line, so that, by the terms of the suggested arrangement with the government, a dividend of from 24 to 30 per cent. on the capital invested in the East Indian line would become permissible. Let us see how far a dividend, approaching to this amount, could be obtained.

The cost of locomotive power varies on different railways, with the price of coke, the quality of the gradients, and other circumstances. On the

Great Western Railway, the cost, Mr. Gooch states, is 0.06 of a penny per ton per mile ; on the Grand Junction, 0.13*d.* ; on the Birmingham and Gloucester, 0.09*d.* ; on the South Western, 0.1*d.* ; and on the London and Birmingham 0.12 of a penny per ton per mile. In this return the economy of the Great Western locomotives appears to be exaggerated, but in other respects it may be taken as a tolerably near approximation to the truth, and 0.12*d.* or $\frac{1}{4}$ th of a penny per ton per mile, may be taken as about the probable cost on the East Indian line. On the Glasgow and Greenock Railway, with a heavy passenger traffic, and coke 18*s.* per ton, the cost of maintaining a locomotive is 8*d.* per mile run ; while on the Bristol and Gloucester Railway, with cheaper coke and a lighter traffic, it is 10*d.* per mile run. On the Norfolk Railway the offer has been made to supply, maintain, and work locomotives at 1*s.* per mile run : we may, therefore, reckon that the locomotives of the East Indian Railway can be worked and maintained, *without* being supplied, for 1*s.* per mile run—the increased amount of engine drivers and engine menders' wages in India being taken as equal to the interest of the money invested in the locomotives. Goods' waggons weigh about 2½ tons each on the narrow guage, and 4 tons on the broad guage, and it is reckoned injurious to the rails to put more than 6 tons of merchandise in each waggon. On the Liverpool and Manchester Railway the average load of a merchandise train, drawn by one engine, is 100 tons, and of a passen-

Cost of
locomotive
power.

Number of
trains neces-
sary per day.

ger train 35 tons ; but these loads are often much exceeded on other lines ; and on a line 5ft. 6in. between the rails, as the East Indian line is proposed to be, the merchandise engines could easily be made sufficiently powerful to draw 200 tons of merchandise each, in addition to the weight of the trucks. If 1,166,048 tons of goods were carried yearly, 3,194 tons would have to be carried daily, which it would require 16 engines to do—8 starting from each end. If these engines were all to start from each end together at six o'clock in the evening, and were to travel at the rate of 15 miles an hour, they would meet at the central station, where the trains would pass one another at nine o'clock in the morning. A passenger train started from each end at six o'clock in the morning, and travelling at the rate of 37 miles an hour, would reach the central station at twelve o'clock in the day, and the goods trains could be detained at the central station until the passenger trains had passed on. The passenger trains would perform the distance from Calcutta to Mirzapore in 12 hours, and the goods trains in 36 hours. 569,684 passengers per annum are 1,561 passengers per day, or 780 passengers per day from each end ; and 4 trains per day from each end would be sufficient to carry this number.

On lines ten years old, and where, therefore, the locomotives are not all new, a locomotive performs, on the average, about 20,000 miles per annum, or only 54.8 miles per day ; if on the East

Indian line 8 luggage trains and 4 passenger trains start from each end in the day, the total number of miles travelled will be 13,080 per day; and the number of times 54.8 is contained in 13,080, or 238, will be the number of locomotives necessary. In round numbers, 250 locomotives may be set down as the number that would be required; and 250 locomotives, at £2,500 each, would cost £625,000, which is £1,146 per mile.

Number of
locomotives
requisite for
the line.

On the London and Birmingham Railway the total cost of the carrying stock has been 1.5 more than that of the locomotives. On the East Indian line the cost of the carrying stock would not be so great in proportion, as there are comparatively few passenger carriages; but supposing the same proportion to apply, the cost of carrying stock, independent of locomotives, on the East Indian line, would be £937,500, making in all £1,562,500 for the cost of locomotives and carrying stock. If, then, the cost be estimated at £3,000 per mile,—which makes the total expense £1,635,000—the cost will be within the estimate, and at this sum we shall reckon it. On the London and Birmingham Railway the maintenance of way and stations, coaching and merchandise charges, and general charges, which together comprise all the expenses, except that of locomotive power, are equal in amount to about $\frac{1}{4}$ th of the receipts: on the East Indian line these expenses would probably be less, as there would be fewer stations in proportion, and

Total re-
ceipts of the
railway.

cheaper wages ; but we shall reckon them at the same amount.

We exclude from this comparison the cost of the locomotive power, for the obvious reason, that it will be much larger on the East Indian line in proportion to the receipts, in consequence of the cheapness of the transport. Reckoning, then, the income by the direct distance—though the expenditure must be reckoned by the actual distance travelled,—and taking the average tariff of the goods traffic at 1*d.* per ton per mile, and of the passenger traffic at $\frac{1}{2}$ *d.* each per mile, we shall have of receipts on the line between Calcutta and Mirzapore, for 1,166,048 tons of goods carried 448 miles at 1*d.* per ton per mile, £2,176,622 ; and for 569,684 passengers carried 448 miles at $\frac{1}{2}$ *d.* per mile each, £531,705, making a total of £2,708,327 per annum. The distance between Mirzapore and Delhi is about 452 miles, and on this length of line we shall have of receipts, for 897,190 tons of goods carried 452 miles at 1*d.* per ton per mile, £1,689,707 ; and for 446,851 passengers carried 452 miles at $\frac{1}{2}$ *d.* per mile each, £420,783, making a total of £2,110,490 per annum. This traffic has all been taken as through traffic, for the obvious reason, that it represents the traffic as ascertained at different points, and is, therefore, to be reckoned as the average traffic along the whole line ; and, although but a small proportion of the goods and passengers may pass through the whole distance,

yet that circumstance cannot affect the result so long as every loss is made up by a corresponding addition ; or, in other words, it signifies nothing whether the whole traffic is a through traffic, or is composed of a short traffic, reckoned in successive lengths through the whole length of the line—the only essential condition being that the traffic at the several points, however composed, is of the amount represented.

Total ex-
penses of the
railway.

There is no need for discriminating between the branch and the trunk traffic ; for if the tariff of charge to the several places to which branches lead is to be reckoned by the direct distance, each of those places is virtually brought upon the trunk line—the only difference indeed being, that the expense of working the branches has to be added to the expense of working the trunk. There will no doubt be a local traffic on the branches which will diminish this expense, and probably extinguish it altogether ; but it will be the safer way to reckon the expense per mile of working the branches at the same rate as the expense per mile of working the trunk, which will be accomplished by reckoning the expense of working the line, as if the total traffic passed through its total length including trunk and branches. The expenses of working the Calcutta and Mirzapore line, which, including its branches, is 545 miles long, will then be as follows :—Locomotive power for carrying 1,166,048 tons, 545 miles, $\frac{1}{4}$ th of a penny per ton per mile, £330,987 ; traction of 8 passenger trains per

Excess of
receipts over
expenses.

day for 545 miles, at 1s. per mile, £77,568; maintenance of way and stations, coaching and merchandise, charges and general charges, say $\frac{1}{4}$ th of the receipts £386,903; and haulage of empty waggons, £9,696, making a total of £805,154 per annum. On the Mirzapore and Delhi section, which, including its branches, but exclusive of the continuation to Meerut, is 524 miles long, the expenses will be:—locomotive power for hauling, 897,170 tons, 524 miles, £224,858; 6 passenger trains, drawn 524 miles per day, at 1s. per mile for each £57,378; maintenance of way and stations, coaching and merchandise charges and general charges $\frac{1}{4}$ th of receipts, £301,498; and haulage of empty waggons, £9,563; being a total of £593,297 per annum. On the Calcutta and Mirzapore section, the receipts per mile will be £4,969, and the expenses per mile £1,495, leaving £3,474 per mile, which, after deducting the charge due to depreciation, will be available as dividend. On the Mirzapore and Delhi sections, the receipts per mile will be £4,021, and the expenses £1,113, leaving £2,908 per mile, available for depreciation and dividend, or a mean of £3,191 per mile upon the whole line, including all the branches.

These results are sufficiently encouraging; but before the profits of the undertaking can be determined, it is necessary to fix the cost; and here some complications have been needlessly introduced by the government, or its subordinates, which it becomes necessary to disentangle. Mr. Stephen-

son appears originally to have contemplated a cheap description of railway for connecting Calcutta with Mirzapore and Delhi; but this view of the matter did not satisfy Mr. Simms, who, in a letter to Mr. Stephenson, dated January, 1846, says, "The character of the works I may deem it my duty to recommend the government to require, may perhaps be of a better kind than you originally contemplated—such as a double line of rails to a great, if not the whole extent; but this difficulty, if it prove such, you state your company is prepared to meet by increasing their capital." The capital could no doubt have been increased, if the government had extended the guarantee, but the government refuses to give a guarantee upon a larger sum than three millions, which would not be sufficient, even for a single line from Calcutta to Mirzapore. It appears that it was a single line Mr. Stephenson originally contemplated: Mr. Simms says, "The construction of the line between Calcutta and Mirzapore will probably cost more than a casual observer might from the appearances of the country suppose; for, although the earth works, will, with few exceptions, be light, the masonry works to cross the rivers will be heavy. I do not think with you, that the adoption of a double line at once will very materially increase the cost as compared with the total outlay, because I should at all events advise that the bridges should be constructed of sufficient breadth to admit hereafter of a second line of rails; and the masonry works will be found, as

Quality of
railway to be
preferred.

Expensive
stone struc-
tures, need-
less and in-
expedient.

before stated, the great item of expenditure." But wherefore should masonry works be adopted to such an extent, as to become the 'great item of expenditure?' Is the prosperity of a railway company to be endangered, or the utility of its project curtailed, by imposing upon it the performance of needless feats in architecture? No doubt the railway should be constructed in a durable and substantial manner, so as to be capable of withstanding a large traffic and a high rate of speed, without involving the necessity of continual repairs; but these conditions can be attained without making stone work the great item of expenditure, and the experience in English railways latterly acquired shows that timber bridges and viaducts are for the most part preferable to those constructed of stone. By kyanizing the wood, or otherwise suitably preparing it, a great durability is attainable, and the timber viaducts have in every case proved themselves to be substantial and satisfactory—and have, in no one instance, like the Barentin Viaduct, or the stone bridges on the Aberdeen, North British, and various other railways, suddenly tumbled down. In the American railways, timber has always been largely employed, and in the English railways its use has of late years been rapidly extending—not merely because it is cheaper than stone, but because it is in most respects better. There does not appear to be any good reason in the case of Indian railways, for resorting to the exploded practice upon European lines, of squandering money on gi-

gantic works in stone, for the white ants have been raised into a bugbear only by those orientals, who construct impossibilities out of fancies, or impediments such as the most moderate capacity may surmount. And if timber viaducts be for the most part employed, the stone work can no longer be the great item of expenditure; and the question again arises, whether it would not be advisable to commence all the railways as single lines? A single can be constructed as substantially as a double line; and if timber viaducts be chiefly used, there is no necessity for making them wider at first than is sufficient to accommodate the single track; for such structures can be widened at any time when provision has been made for that purpose. Under these conditions, a single line would not cost much more than half the sum that a double line would cost; and with the same expenditure, it would open up nearly twice the area of country, and render available for its support nearly twice the extent of infiltrating surface. A single line connecting Mirzapore with Calcutta would suffice for the transmission of all the traffic, even if it were increased fourfold; and the same remarks applies still more emphatically to the other Indian lines.

A single line
sufficient,
and most
wise.

In the present position of the money market, only a limited capital is obtainable, even for the construction of the best railways; that capital will be more easily got if expended upon the construction of single lines, than if spent upon double ones, inasmuch as a larger return may thus be expected from the single lines, and the expendi-

Requisition
of double
lines presses
upon the
Company
without
benefit to
the Govern-
ment.

ture of any given amount of capital upon such railways, will be of nearly twice the utility to the public, as nearly twice the extent of country will participate in the advantage of the amelioration. Upon what plea, then, can the formation of double lines be justified? No doubt, if the money were obtainable for double lines, on the conditions offered by the government, it would be natural enough that it should prefer all the main trunks to be made at once with a double track and be exclusively formed of such imperishable materials that they might last to the day of doom; but the question is more properly a financial than an engineering one; and the circumstances of the money market have so much changed since Mr. Simms' views were propounded, that his stringent conditions are no longer maintainable. Companies cannot be coerced by a hard bargain, where no corresponding benefit is accorded and the fever of speculation has passed away; and if the present companies, which had their origin in some measure in the recent railway excitement, are broken up, who can say when others will be constructed? The course of procedure prescribed to the railway companies should be identical with that followed, if the government was itself making the railways, as Mr. Simms indeed himself elsewhere maintains; and it is hard to believe that the formation of a double line could then be advantageous to the government in any case in which a single line would serve the turn.

In the first dispatch from the Court of Directors to the Bengal Government on the subject of

Indian railways, it is stated, that one of the functions of the railway commission would be "to suggest some feasible line of moderate length, as an experiment for railroad communication in India;" and two pieces of the trunk line, one extending from Calcutta to Barrackpore, and the other from Allahabad to Cawnpore, were accordingly recommended. But what, it may be asked, is the proposed experiment to discover? It is clear that an experimental railway can establish no general conclusions respecting cost or traffic, inasmuch as those elements depend more upon the population, wealth, and physical conformation of the district selected, than upon any such accidents as its latitude and longitude. It may indeed teach something as to the comparative durability of different modes of construction; but are all the other Indian lines to remain in abeyance for some half a century, until it is seen how the experimental line withstands the ravages of time? The truth is, new tests of durability are not needed; for the materials entering into the composition of railways, have been tested for ages in other combinations, and an experimental line as a test of durability, is no more required in India than it is in England. The works of the Indian railways, in common with those of every other country, must consist of masonry, timber, and earthwork; and a new railway, or any number of them, could add nothing to the evidence of the durability of those materials, always accessible. The bounds or embankments.

Inutility and
futility of an
experimental
line.

Question of
peculiar at-
mospheric
influences
already an-
swered.

in the Deccan, constructed to shut up in narrow valleys the waters descending from the hills, are certainly in some cases more than 800 years old ; yet these embankments have withstood all the unfavourable influences of the climate, though pressed upon by a large volume of water ; many of the stone structures are of a still more remote antiquity ; and timber is too familiar an article, and the durability of the different kinds is too well known, to need new experiments to determine it. Some of the embankments of the road leading from Chittagong to Comillah, constructed by Mr. Elliot, about 1795, are from 20 to 30 feet high ; and the road, which in most of its works much resembles a railway, passes through a country much exposed to inundation ; nevertheless, every part of the work has been exempt from disaster ; and such a result tells far more than anything the brief experience of an experimental railway could unfold.

The climate of the southern portion of the United States very much resembles India ; yet in America no impediment has been experienced from atmospheric causes ; and does any one doubt, that if India had been in the hands of the Americans, it would not long before this time have been intersected by railways ? Cuba even has its railway, which has been open to the public for 9 years ; and a short line, the Red River Railway, has been for some years in existence at Madras, which might be appealed to touching any question of durability, that an experimental railway might be

thought competent to determine ; but any new line, as a criterion of durability, is obviously superfluous, and a *piece* of railway could not even determine the probable traffic of the district through which it extended. Pilgrims in India would not use a short line, nor would merchandise be committed to it, to be exposed to the risks, expense, and damage of transshipment. Such a work would be like a river shorn of its branches ; or, to use a more artificial simile, it would resemble an aqueduct, of which the fountains were dried up or diverted. It would signify but little that such a conduit existed, if the waters, instead of being led into it, were dissipated by evaporation, or passed off through their ancient channels ; and a railway, to be the aqueduct of commerce, must be formed to collect, as well as to transmit the stream—an end obviously promoted by making one half of the railway a tributary of the other. A piece of the East Indian line, extending 150 miles, or even 300 miles towards Mirzapore from Calcutta, could not attract to itself the Ganges trade, without which it could not be successful ; and the result of constructing such a segment as a beginning, would be to damn the whole of the Indian lines in the public estimation, by holding up as a specimen of their success, a result which would most probably be a failure.

An isolated
railway a
monitory
scarecrow.

In most of the other Indian lines a few miles more or less in the length is a question of no moment, and to the upper portion of the East In-

More risk
upon the
proposed
pieces of
double line
than by a
single line to
Mirzapore.

dian line the same remark might be applied, for whether the line goes on to Delhi or only to Agra, could not signify much ; but in the lower portion of the line it is an indispensable condition that the railway after leaving Calcutta should not stop until it reaches Mirzapore, as on no other condition can the Ganges trade be commanded. To stop short at Raneegunge or Shahurgatee, would be very much like the Birmingham railway stopping at Tring, and between the construction of the whole line to Mirzapore, or none of it, there appears to be no judicious alternative. There will be far more risk to the government in giving a guarantee upon the 3 millions understood to have been offered for the formation of the *pieces*, than in giving a guarantee even upon a considerably larger sum for the formation of a single line to Mirzapore, with the Patna and Benares branches ; for whatever opinion may be formed as to the prospects of the segments it cannot be doubted, that a single line of economical construction, connecting Calcutta with the great marts upon the Ganges, would return a large profit, and lay the foundation of a prosperity which might aspire higher when it had been rendered secure.

In planning railways for the service of India reference must always be had to the high value of money in that country, and a different adjustment of the law must there obtain, which regulates the investment of capital in works of art, to purchase either a great durability, or a diminution of the current expenses. We have already recommended

that the lines should at the outset be single ones, and that timber should be largely employed in the viaducts and bridges; and the principle we have just indicated shows that less fastidious gradients than those usual in this country, may be adopted. The question of gradients is merely a question of load, or of the expense of tractive power; and in consequence of the difference in the rate of interest in the two countries, an outlay on gradients that was judicious in England might in India be altogether indefensible. Fortunately, upon most of the Indian lines there are but few gradients of any difficulty to encounter, but it is most important to keep down the cost to the lowest possible point, consistent with strength and firmness of construction. Larger scantlings than are common on the English lines should be adopted, for on none other than substantial railways are high speeds attainable with safety, and no saving should be tolerated which compromised the efficiency of the line; but the whole may be saved that has been dissipated in the case of the English lines on works of ostentation, in creating a superfluous railway power by putting a double track where a single one was sufficient, and in purchasing by a large increase of the cost a slight diminution of the current expenses.

Operation of
a high rate
of interest
upon the
gradients to
be selected.

The average cost of railways in this country has been about £35,000 per mile, inclusive of carrying stock and stations. In America there are railways which have cost only £1,600 per mile, but the usual cost is from £3,000 to £4,000 per mile. The cost

Cost of
American
lines.

of the the Utica and Syracuse railway, which is a well finished line, and regularly traversed by locomotives maintaining a good speed, was £3,600 per mile; the cost of the Auburn and Rochester was £2,900 per mile; of the Richmond and Potomac, £3,600; of the South Carolina, £2,600; and of the Alabama Florida and Georgia, £3,200 per mile. Most of the American lines are formed with a single track and there has never been a case of collision, or other accident upon them—the rule of the road being that the train first reaching the station goes into a siding to allow the other to pass, and there are thus never two trains upon the same section of the line at the same time. The construction of the American lines is not sufficiently substantial for the high speeds India ought to possess, but the cost would not be doubled if they were made twice as strong: and with such prices in America, where although some of the materials are cheap, labour and iron are expensive, it is impossible to doubt, that an excellent and substantial single line could be constructed in India, inclusive of the few hundred pounds per mile required for the electrical telegraph, for £7,000 per mile; for in India, the labour is cheap, the land is to be had for nothing, the timber for the trouble of felling it, and all the other articles free of duty. £7,000 per mile for the railway, and £3,000 per mile for locomotives, and carrying stock, makes a total of £10,000 per mile, to which sum it appears expedient that the cost should be restricted. This would make the

capital requisite for the formation of the line from Calcutta to Mirzapore, with its branches, £5,450,000.

Mode of
bridging the
Saone.

We have already stated that the country generally between Calcutta and Mirzapore is favourable to the construction of a railway, the only exception to this remark being the bridge across the Saone, which requires to be upwards of two miles long; while the river rises in floods to a height of 30 to 40 feet, and the foundations are nothing but sand so far as has yet been discovered. There is nothing of difficulty, however, in this work, which skill and capital may not overcome; and as the chief impediment is the expense, it is proper to form some estimate of the expense, which in its turn involves the consideration of the mode of procedure to be adopted. In summer there is very little water in the river, and if a foundation cannot be found at a moderate depth, it can easily be made by driving two rows of sheet piles into the sand—extending across the river and at a distance from one another, equal to the breadth of the viaduct—and then attaching to these piles a platform which will confine the sand, as in a gigantic box, and give the necessary support to the structure to be reared upon it. Before the application of the platform the whole of the sand between the walls of sheet piling could be turned into rock by pouring upon it a ferruginous water—in the manner the plum-pudding-stone rocks are formed in the Thames, by the agglutinating action of ferruginous springs upon the banks of gravel—

Cost of timber bridge.

the small quantity of water in the river being first diverted to the one bank and then to the other, to permit this operation. The foundation being obtained the bridge becomes a mere timber viaduct, the expense of which per yard forward can easily be estimated by comparing it with similar structures.

The expense of the Yarrow Viaduct, on the North Union Railway, which consists of trussed beams with timber piers, was £23 per yard forward, the height being 73 feet. The West Brandywine and Valley Creek Viaducts in America, which are formed with timber arches resting on stone piers, are 72 feet, and 56 feet high above the water respectively; the former cost £42 per yard forward, and the latter £25. The Sherburn Viaduct, on the Newcastle and Darlington Railway which is altogether of timber cost £30 15s. per yard forward. It is from 60 to 70 feet high at the highest place, and rests upon piles driven 35 feet into the ground. The piles are of American rock elm, 12 inches square, and upon the tops of the piles, blocks of masonry, 3 feet deep and 4 feet square are placed, upon which the balks rest. These upright timbers are from 12 to 13 inches square, and there are two piles to every upright: the distance between the uprights is 20 feet in the direction of the bridge, and athwartships 7 feet at the roadway, and 11 feet at the ground—the timbers spreading laterally at the bottom for the sake of greater stability. The whole of the timber, except that used for the

piles, is of Memel. In some respects a bridge over the Saone would be more expensive than this viaduct; but looking to the cheapness of timber in India, which may be had for the use of the railway for the mere cost of cutting it, the expense per yard forward, would probably be moderate.

Probable
cost of the
Saone
bridge.

As the bridge will require to be 2 miles and 3 furlongs, or 4,180 yards in length, the cost, if taken at same rate per yard forward as that of the Yarrow Viaduct, will be £96,240. This is a less cost than that of the Congleton Viaduct, on the Manchester and Birmingham Railway, which amounted to £113,000; so that the cost of the Saone Viaduct, though large, will certainly not be unprecedented. The Yarrow, as well as the Sherburn Viaduct, is designed for a double line; and it would probably be found expedient to make the Saone bridge double also, as the unoccupied portion might be used intermediately for the accommodation of travellers by the road, a toll being of course charged upon all persons or vehicles passing over it. It might also be expedient to make provision for carrying a carriage road and foot way above the railway, so as to have the power of perpetuating the accommodation to the road, even after the second line of railway has been opened to the public. These, however, are details which we need not here consider; but it is important to understand that there is no impediment presented by the bridging of the Saone that will necessarily cause the cost of the railway to exceed £10,000 per mile, even

Methods of
preserving
timber.

though that structure were to be several times more expensive than it will probably prove.

It appears to be indispensable that the whole of the timber employed in railway works in India, whether for sleepers or viaducts, should be so prepared as to prevent decay, and to be capable of resisting the attacks of the white ants. There are several known means by which both of these ends may be attained ; but it is important to ascertain how the required immunity may be reached with the least expense. Payne's and Kyan's processes for preventing rot of every kind in timber, are largely employed in this country, and are known to be effectual ; and in India kyanized timber has been found to be exempt from the attacks of the white ants, if it has been thoroughly penetrated by the preservative solution. A curious illustration of the efficacy of Kyan's process is recounted in Mr. Stephenson's report. Some pieces of prepared wood, which had been received several years previously by one of the builders in Calcutta, were found, after long exposure, to be entirely eaten out in the inside by the white ants, while the exterior, so far as the preparation had penetrated, remained perfectly sound and untouched. By the use of hydraulic pressure the wood is now penetrated throughout ; but the apparatus is cumbersome and costly, as it requires to be very strong to withstand the pressure.

The cost of preparing timber in this country, according to Payne's process, is 14s. per load, or up-

wards of 3d. per cubic foot; and although in India the cost might be less, yet it is to be apprehended that the cost of Payne's or Kyan's process would amount to a very large sum where the preparation of so large a quantity of timber was necessary. It is worthy of consideration whether Boucherie's method of preparing timber, which has been much used in France, would not be preferable for Indian purposes to any of those processes which involve the use of hydraulic pressure. By Boucherie's plan the preservative liquid is introduced into the trunk of the live tree, which, by the action of its capillary vessels, sucks the liquid up, and diffuses it throughout the entire substance of the timber. If this plan were adopted, it would only be necessary, after selecting the trees in the forest, to bore through the trunk of such as are to be cut down as near the ground as convenient, and to run a wide saw cut from the hole towards each side, leaving timber enough uncut to maintain the tree in the perpendicular position. In this cut the preservative liquid is to be kept for a few days by any suitable arrangement; but if kept too long it will penetrate to the twigs and leaves, and thereby occasion a waste of the preservative material.

Methods of
preserving
timber.

Pyrolignite of iron prevents every kind of rot, but coal tar appears to answer the same purpose; and it is both a cheaper material and one to which the white ants appear to have a great antipathy. The white ants will not touch the iron wood of Moulmien, they do little or no damage to teak, and there

Methods of
preserving
timber.

are various other woods which resist their attacks. The *Englishman*, of March 1st, 1845, says—"It is an utter mistake to suppose that timber cannot be found to resist white ants; there is abundance in this country that will, for a period as long, if not longer, than the common pine timber used in England, resist the weather of that climate." There is no doubt that the difficulty presented by the white ants has been much exaggerated; it is found that they do not attack timber over which there is any traffic, and the vibration of a railway train, it has been alleged, would deter them from committing ravages upon the timber employed in railway constructions; but nothing must be left to chance in so momentous a question, and it appears desirable that the whole of the timber should either be kyanized, or be impregnated with tar by Bouche-rie's process, both as an antidote against the white ants, and as a preservative against decay. It may, perhaps, be found expedient to construct the piers of the bridges, over the Nuddea rivers, of iron or stone, instead of timber, to obviate the attacks of worms which some rivers contain; but this course would not be necessary in the case of the Saone bridge, except, perhaps, in one or two of the central piers, as the whole of the other piers would rest on dry land, except during the winter floods.

Taking then, the cost of a single line between Calcutta and Mirzapore at £10,000 per mile as the price which must not be exceeded, and to which the plans of the engineer must conform; and sup-

posing the whole of this line, with the branches to Patna and Benares, were completed at once at a total cost of £5,450,000, the profits of the undertaking may be ascertained from the following comparison of the receipts and expenses :—

Profits on
East Indian
Line.

Line between Mirzapore and Calcutta.

<i>Receipts.</i>		<i>Expenses.</i>	
1,166,048 tons carried 448 miles at 1d. per ton per mile	£2,176,622	Locomotive power for carrying 1,166,048 tons 545 miles at $\frac{1}{4}$ th of 1d. per ton per mile	£330,987
569,684 passengers carried 448 miles at $\frac{1}{4}$ d. per mile each	531,705	Drawing 8 passenger trains per day 545 miles at 1s. per mile.	77,568
Mails, treasure, parcels, troops and military stores	Not reckoned.	Maintenance of way and stations, coaching and merchandise charges, and general charges,—say $\frac{1}{4}$ th of the receipts	386,903
		Haulage of empty waggons	9,696
		Depreciation 10 per cent. on £5,450,000	545,000
		Balance available for dividend being £24 2s. per cent.	1,358,173
	<u>£ 2,708,327</u>		<u>£ 2,708,327</u>

This shows a clear profit of 24 per cent. On the Mirzapore and Delhi section of the East Indian line, which, including the branches, is 524 miles long, and which, at £10,000 per mile, would cost £5,240,000, the return would be as follows :—

Experimental line.

<i>Receipts.</i>		<i>Expenses.</i>		Result of Experi- mental Line.
106,754 tons carried 150 miles at 1d. per ton per mile	£66,721	Locomotive power for carrying 106,754 tons 150 miles at $\frac{1}{4}$ th of a penny per ton per mile	£8,340	
569,684 passengers carried 150 miles at $\frac{1}{4}$ d. per mile each	178,026	Drawing 8 passen- ger trains per day 150 miles at 1s. per mile	21,900	
		Maintenance of way and stations, coach- ing and merchandise charges, and general charges, $\frac{1}{4}$ th of receipts	34,964	
		Haulage of empty waggons	2,737	
		Depreciation 10 per cent. on £1,500,000	150,000	
		Balance applicable to dividend being £1 15s. 9d. per cent	26,806	
	<u>£ 244,747</u>		<u>£ 244,747</u>	

Thus it appears that the returns upon the experimental line, computed *on the same data*, which exhibit a profit of 24 per cent. upon the line connecting Calcutta with Mirzapore, show only a profit of £1 15s. 9d. per cent. upon the capital invested, supposing the line to be a single one; while, if made with a double track, so as to cost £18,000 per mile, there would not only be no profit, but a *loss* of £98,194 per annum, or about 31 per cent. This, of course, is only an extreme case; and supposing the railway to be confined to this piece of a line, without any intention to extend it. The objection is in a great measure removed, if

Losses of
experimen-
tal line.

it is regarded as only the first portion of the longer line which is to be afterwards constructed ; and this is the light in which it is most probably regarded by the railway company. The question, however, is not before us for immediate decision, as the government of India will no doubt weigh the relative advantages before finally determining this point. As regards the traffic, though we have reckoned the same number of passengers to travel by the experimental line as by the through line, it is very questionable whether this anticipation would be verified by the result. Pilgrims passing to Benares would rather provide themselves with suitable conveyances at Calcutta than be carried by the railway a third of the distance, to be set down in a region where conveyances could not be got ; and many of them would no doubt still continue to journey by the road and the Ganges. The conveyance of such merchandise alone could be reckoned upon by the experimental line as now proceeds by the road and Damooda, and the quantity thus transported is insufficient to warrant the construction of a double-track railway for its special accommodation.

It may be satisfactory to compare the prospects of the East Indian line with the original estimates of profit, and the actual results upon some of the English lines which it the most nearly resembles. On the Liverpool and Manchester Railway the original estimate of passenger traffic was £666 per mile per annum ; on the Calcutta and Mirzapore line the passenger traffic, which forms but a small proportion of the receipts, amounts to £975 per

mile per annum. On the Liverpool and Manchester line the passenger traffic at the end of four years, was found to be nearly four times greater than the estimate; on the Calcutta and Mirzapore line, though a similar increase is probable, no addition to the present traffic is reckoned upon. In the prospectus of the Grand Junction Railway the total annual receipts for passengers and goods is estimated at £1,480 per mile per annum. On the Calcutta and Mirzapore line the annual receipts from passengers and goods is estimated at £4,969 per mile per annum. On the London and Birmingham Railway, the number of passengers during the first year was 608,564, carried on the average 65 miles, equal to 353,184 passengers carried the whole length of the line. The quantity of goods carried was about 63,000 tons, and these were the quantities *after* the increase due to the formation of the railway. On the Calcutta and Mirzapore line, *before* the realization of any such increase, the passenger traffic is found to be 569,684 passengers per annum, and 1,166,000 tons of goods; being about twice the number of passengers, and 18 times the quantity of goods. On the London and Birmingham Railway, the passenger traffic increased 110 per cent. in 5 years, and the goods traffic 85 per cent. The cost of the London and Birmingham Railway was upwards of £50,000 per mile; the cost of the Calcutta and Mirzapore railway will be £10,000 per mile. Single lines of railway have been constructed in this country for less than £10,000 per mile. The cost of the Aylesbury railway was £7,000 per mile,

Comparison
of the East
Indian with
London and
Birmingham
line.

Cost of Eng-
lish single
lines.

including carrying stock, and the purchase of land. This was also the estimated cost per mile of the Yarmouth and Norwich line, as computed by the Company's engineer ; the actual cost, inclusive of the electric telegraph, has been about £8,000 per mile, though between a fourth and a fifth of the capital was expended in law charges, and compensation for land.

Such, then, are the prospects of the East Indian Railway ; and if the course recommended be followed of making a continuous single line, with as much double line at the termini as the restricted expenditure will permit, it certainly promises to be the most profitable railway project ever undertaken. Nor can there be any doubt as to the extent of the traffic, which has been derived from official documents, cited in Mr. Stephenson's Reports, and which leave nothing to conjecture. There cannot be a doubt, that the traffic of the Ganges is a million tons a year, and it is equally certain that the charges at which the revenue of the railway is computed, are less than those incidental to any of the existing modes of transport. Whether a railway which carries more cheaply than a barge or a wagon, as well as more expeditiously, will obtain a preference in the market it is superfluous to enquire, for those who dissent from this conclusion are beyond the reach of argument ; and that it will obtain a preference, is indeed the initial postulate on which our whole investigation proceeds ; but those who admit that in locomotion as in other things, the best and cheapest article will be the

one selected, will find themselves constrained to acquiesce in the whole of the subsequent deductions. A section of the line formed after a careful survey, shows that, for three-fourths of the distance between Calcutta and Delhi, the ground is almost level, rising only 1 in 1,500; and the worst gradient which extends but for a very short distance, is 1 in 61. There are only two short tunnels on the whole length of the line, and scarce any heavy earth works, so that, as Mr. Simms remarks, the chief expense as regards engineering structures will be the bridges, the cost of which, per yard forward has been already considered. There are only three bridges—those over the Hoogly, the Saone, and the Jumna, likely to be formidable from their expense; the worst, which is that over the Saone, we have already reckoned as likely to cost £100,000; but, taking the cost of each of the three at double that amount, there is still nothing in such an expenditure sufficient to prevent the line from being made with a single track for £10,000 per mile, and which sum it must not be left optional with the engineer to exceed. The extent and cost of the present traffic, being established facts which cannot be controverted, and this traffic being secured to the railway, by a diminution in the charges, a revenue will result of which the amount may be ascertained by the simplest arithmetical operations, and which, with the same cost and the same current expenditure, will be found to accord with the estimate of profits we have given.

Cost and profits of East Indian line.

CHAPTER IV.

GENERAL REFLECTIONS RESPECTING INDIAN LINES.

Great Indian
Peninsula
and Madras
Railways.

THE only railways in the Bombay and Madras presidencies which appear likely to be carried into practical operation, are the lines projected by the Great Indian Peninsula Railway Company, and the Madras Railway Company; both of which are undertakings of promise, and are promoted by men of known means and commercial standing, whose names give confidence to the public. The Great Indian Peninsula Company proposes to run a line from Bombay across the peninsula of India to Coringa, at the mouth of the Godavery, sending out occasional branches, of which no very distinct scheme appears yet to have been formed; but in the first instance the line is only to be carried from Bombay to Alleh, 109 miles distant, with branches or extensions to the Pera river, 31 miles, and to Mhuse, 36 miles, making 176 as the total length of railway at first to be undertaken. Mr. Chapman, the managing director of the Great Indian Peninsula Company, who has investigated the probable

profits of the line with great patience and ability, reckons that he will be able to form a double line of railway for £10,000 a mile; and that the existing traffic, if secured to the railway by moderate charges, will pay a dividend of 11 per cent.: but it does not appear at all probable that a double line could be formed across the Ghauts, inclusive of carrying stock and stations, for £10,000 per mile, though a single line might perhaps be made for that amount.

Cost of Indian Peninsula underrated if double.

The Madras Railway is intended to be a single line, and will extend in the first instance from Madras to Wallajahnuggur, a distance of 70 miles; but should the result be such as to encourage the further prosecution of the enterprise, it will be carried on to Arcot, Vellore, and Bangalore, and eventually, perhaps, to Seringapatam and Calicut. The facilities of construction consequent on the level nature of the country through which the line passes, are such as to make it probable that it can be made at a cost of about £7,000 per mile, inclusive of carrying stock and stations. Mr. Simms says that he considers the annual expense of working the line, and maintaining both it and the plant in perfect repair, will not be less than 20,000*l.*; and with 30,000 tons of goods at 2*d.* per ton per mile, and 150,000 passengers at $\frac{1}{2}$ *d.* per mile each annually carried along the line, he estimates the receipts at 50,312*l.*, leaving 30,312 divisible as profits, or 6 per cent. on the capital. It does not

Direction of
Madras and
Indian Pe-
ninsula lines.

appear probable, however, that more than $\frac{1}{2}d.$ per mile each could be got for the passengers, but $2\frac{1}{2}d.$ per ton per mile could be got for the goods.

The line leading from Bombay to Alleh, passes over the Malsej Ghaut at Koobee, about 86 miles from Bombay, by means of an inclined plane 6 miles long, and rising on the average 1 in 18, but in some places 1 in 15. This plane is to be worked by means of three pair of engines giving motion to endless ropes. Near the Ghauts the earthworks are heavy, and there are a great number of tunnels; the collective length of the tunnels upon and above the Ghauts is 3780 yards, and below them 6,000 yards, making a total length of 6 miles of tunnels through rock. It does not appear probable that the line from Bombay to Alleh can be constructed at as small a cost per mile as the line connecting Calcutta with Mirzapore; but the cost of the carrying stock will be less, as there will be a smaller traffic upon it, and the extensions also will be less costly than the main trunk: so that it is not improbable that a single line 179 miles long, if the tunnels be kept single also—as upon the South-Western line, where it pierces the Dover cliffs—could be formed at a cost of £1,868,053, which is the cost as estimated by Mr. Chapman, of the portion of the Indian Peninsula line at present proposed to be undertaken. The following is Mr. Chapman's estimate of the receipts and expenditure :—

Great Indian Peninsula Railway.

<i>Receipts.</i>		<i>Expenses.</i>	
180,000 tons carried between Bombay and Alleh, 109 miles, at 2½d. per ton per mile	£224,812	Annual cost of working the line from Bombay to Alleh, with 180,000 tons of goods	£74,021
90,000 tons carried between Alleh and the Pera river, 31 miles, at 2½d. per ton per mile	31,969	Annual cost of working the line from Alleh to the Pera river, and from Alleh to Mhuse	22,357
90,000 tons carried between Alleh and Mhuse (12 miles from Seroor) 36 miles, at 2½d. per ton per mile	37,125	Balance applicable to dividend, being £11 0s. 11d. per cent. on £1,863,053, the cost of construction	205,778
Additional revenue for 120,000 tons carried up the Malsej Ghaut, double mileage, being 2½d. per ton per mile for 6 miles	8,250		
	<u>£ 302,156</u>		<u>£ 302,156</u>

This estimate though deficient in data showing how the working expenses have been derived, appears to be tolerably near the truth; and if there are errors in it, they must about balance one another, as the result nearly accords with that arrived at by other methods of determination. The amount of traffic at present subsisting in the districts traversed by the railway, has been investigated by Mr. Chapman with great care and industry, and the quantities at which he arrives are probably nearly correct, though the method he pursues in fixing the traffic in salt, by taking the average population

Indian Pe-
ninsula
should be a
single line.

and the average consumption of each individual is liable to material error in a country like India, where the people are too poor to be able to afford a consumption of 16 lbs. of salt each per annum ; salt in India being a costly article on account of the high duty imposed upon it. There can be no doubt, however, from the facts Mr. Chapman adduces, that the traffic he anticipates will be fully realized, and the only risk is that the cost of the line may exceed the estimate, which will certainly be the case if £10,000 per mile is set down as sufficient for the construction of a double line, and which should not therefore be attempted.

On both the Bombay and Madras Railways the amount of traffic is very much smaller than on the East Indian line, but a higher price is obtainable for transport on account of the absence of river competition, so that a smaller traffic will enable them to pay ; and as with *the present traffic* they are capable of returning a profit considerably exceeding the guarantee, it appears expedient that the guarantee should be extended to them. The effect of the formation of a good road in India has invariably been to increase the traffic ; and in countries in which good roads already exist the formation of a railway has the same operation. By the improvement of the Allahabad and Cawnpore road the traffic *quintupled* itself in seven years ; and by the improvement of the road leading from Kamptee to Bellary, the exports from Kamptee so increased that the customs rose from

£4,622 to £18,015 in three years. The immediate effect of opening the Liverpool and Manchester Railway was to increase the number of passengers three-fold; and the invariable effect of the formation of a railway has been greatly to increase the traffic. If then this be the effect of the facilities successively afforded by roads and railways, what increase may not be expected where these successive steps are taken simultaneously? The facility of locomotion attained by other countries in successive stages, appears likely to be realized by India by a single giant stride; and the grandeur of the results must be correspondent with the vastness of the innovation. In dealing with the question of profits however, it is necessary to put a rein upon the imagination, and to cast out every element of a hypothetical nature, for it is facts and not hopes which justify the investment of capital; but the safety of the investment once demonstrated the contemplation of additional benefits becomes permissible. A railway is sure to be a sound undertaking which is profitable, without the increase of traffic it will certainly create, and which rests its pretensions rather upon established facts than upon vague and brilliant anticipations.

Ratio of increase of traffic on Indian lines.

In giving a guarantee then of $3\frac{1}{2}$ or 4 per cent. upon the 54 millions required for the formation of the line between Calcutta and Mirzapore, upon the 1 million requisite for opening the line connecting Bombay with Allah, and upon the $\frac{1}{2}$ million re-

A guarantee
on 7 millions
for lines in
the three
presidencies
to be recom-
mended.

quired for the formation of the line between Madras and Wallajahnuggur, the government appears to subject itself to no risk which might not be insured at a moderate premium, and its concession of a guarantee would at once enable the lines in the three Presidencies to proceed. The total sum on which the guarantee is necessary is seven millions; which at 4 per cent. amounts to £280,000 per annum, as the sum the government would have to pay if the railways produced nothing: and such are the benefits the government would derive from the introduction of railways, that they would be cheaply purchased even at that amount. But if single lines be adopted, the risk to the government will become so trifling that it may be insured for a very small amount—perhaps 1 or 2 per cent.; but at 5 per cent. the maximum expense to the government arising out of the guarantee is only £14,000 per annum. The objection is an obvious one, that if the risk to the government be small, it will be equally so to individuals, and that therefore a guarantee is superfluous; but although this argument is conclusive in the case of English projects, it is by no means so in the case of undertakings projected in a country so far away as India, and so full of mystery to the bulk of the English people.

The claim for a guarantee upon Indian railways does not rest on the same basis as that upon Irish railways which was recently disallowed; for in India the government is the first recipient of the

benefits the railways will confer—the inevitable operation of the railways being to increase the public revenue to an extent greatly exceeding any possible expenditure under the guarantee, provided the railways be made in the manner recommended, and be opened at the first as single lines. The risk involved by the guarantee upon 3 millions expended upon the formation of pieces of double line could not be insured for the same sum, as the risk upon the 7 millions expended upon single lines in the three presidencies as already suggested; neither would the benefits to the public or the government be so extended or decisive; and it appears to be injudicious therefore to limit the guarantee to the smaller sum, when there is in reality less risk attaching to the larger. The proposed limitation, moreover, would probably have the effect of breaking up the Bombay and Madras Companies, which would occasion much dissatisfaction in those Presidencies, and would indeed be a great public misfortune; for each of those companies, if kept in existence by a small concession, would become the nucleus of more extended undertakings, and would in time be able to accomplish the formation of lines overrunning the whole peninsula of India without further government assistance. If this be so, the government will certainly incur a grave responsibility if, to evade a nominal risk, they shut out India from the benefits of railway communication; and that by granting a guarantee upon 7 millions, the railway

More gain to the government by the railways than it can lose by the guarantee.

Method of
completing
subsequent
lines without
a guarantee.

companies would be enabled to complete their grandest designs, will appear from the following considerations :—

The capital required to carry the railway from Calcutta to Mirzapore is $5\frac{1}{2}$ millions; and that sum, under the government guarantee, could easily be collected. About 2 millions more could be raised by way of debenture, which would carry the line at least as far as Cawnpore; and this is the utmost that could be undertaken until the railway was opened to the public. So soon as the railway was opened, however, and its traffic ascertained, the company should be authorised to issue railway notes or tokens to an extent proportionate to the traffic, which notes would be receivable in payment of railway transport, in the same manner as the penny stamps in this country are received in payment of postage. The depreciation of the railway notes would thus be as effectually prevented as if they were exchangeable for gold, provided the issue be kept proportionate to the traffic; and reference must always be had in regulating the issue (which is to be done under government direction), to the amount of the government guarantee, and the interest upon the debentures, which must be returned by the railway in money. By the application of these railway notes to the accomplishment of railway extensions, the East Indian line would probably in a few years be carried on to Lahore: the Great Indian Peninsula would be carried on to Coringa, from whence arms would

extend to Madras and Calcutta, and the Madras railway would send its branches over the whole southern portion of the Indian Peninsula. These grand results are all accomplishable by a risk to the government, amounting to fourteen thousand a year; and should the government remain recusant, in spite of the smallness of their adventure, it would be better that the promoters of the several railway companies should unite to insure the guarantee for a fixed sum, than that their respective projects should remain unaccomplished.

Companies
might unite
to insure the
government
risk.

The whole of the Indian lines will of course be of a uniform gauge, and it appears very important that the branches and extensions of each line should as far as possible be in the hands of the original company. No doubt in time there will be points at which branches of different lines will meet one another; but the complications arising out of the tenure by different companies of different parts of the same line, are as much as possible to be avoided. In conformity with this principle, it appears to be expedient, that the line extending from Mirzapore down the valley of the Nerbudda to Bombay, should be undertaken by the East Indian railway company, that the extensions of the Indian Peninsula line to Madras and by Coringa to Calcutta should be accomplished by the Peninsula company, and that the Madras Company should execute any lines undertaken to the southward of Madras. The fields to be occupied by the respective companies should be defined at the outset, so

Districts
should be
allotted to
each com-
pany.

as to obviate subsequent conflicts by which the interests of the public might be endangered ; and the only intelligible principle on which the adjudication can proceed, is that of giving to each company the precedence in working out all the developments of its own line. Of course, if these developments are not carried into effect within a reasonable time by the original company, they should be handed over to any other party willing to undertake them ; but it is better for the public interests that the management of every part of a line, and of the whole of its branches, should be vested in the same hands.

Upon the duration of the guarantee and the tenure by which the railways are to be held many opposite opinions have been propounded ; but perhaps it is on the whole the most equitable arrangement, that the government should have the power of assuming possession of such railways as have a guarantee in 25 years from the time they are opened, upon repayment of the original capital ; and further, that it should have the power of buying up such railways as are not guaranteed, at 25 years' purchase, but not before 5 years after they are opened. Lord Dalhousie, who investigated with much care, the conditions upon which English railways might be purchased with equity by the government, came to the conclusion that 25 years' purchase would be a fair award ; and to these views the railway act appears to conform, but it is only in guaranteed lines that it would be equitable. If these views should appear to be applicable to the

Indian railways, and if such terms could be obtained from the Indian Railway Companies—it being considered sufficient for the guarantee to last as long as the lease—the grant of the guarantee would be the means of saving to the government the difference between the first cost and the market value of those lines over which it extended, when they came to be purchased. Mr. Simms proposes that the period of the lease should remain undetermined for some years, so that its duration may be made inversely proportional to the traffic ; but such transcendental modes of determination though they might answer in dealing with an individual, would not be satisfactory to a public company, where it is necessary to be able to lay before the shareholders information of a more tangible and definite nature, than can be extracted from the vagaries of a sliding scale. It is clear, moreover, that the proposed arrangement offers a premium upon mismanagement and speculation ; for if by good management and economy the profits are increased, the period of the lease will be diminished in the same proportion ; and it is only necessary to mismanage the railways sufficiently, to earn a claim to a lease for ever.

Duration of
the guarantee
and of the
lease.

Before sanctioning the investment of 7 millions in Indian railways, it is right that the government should estimate the probable effect of the measure upon the financial operations of this country. It may indeed be expected, that most of the money invested in railway works in India will

Method of
obviating
inconve-
nience from
an abstrac-
tion of bul-
lion.

eventually find its way back to this country for the purchase of manufactures; but it is not so obvious that any sudden abstraction of a large sum of money would not, in the present prostrate condition of the money market, give rise to serious embarrassment. Fortunately, however, the peculiar conditions involved in the formation of Indian lines are such, that the exportation of any large quantity of bullion may be dispensed with. As far as regards the iron and the engines, it is clear that no export of bullion is involved in the purchase of them: and the only other large expenditure against which it is necessary to provide, is the labour of the natives employed in the formation of the railways. Now it appears very clear from the peculiar habits of the Indian people, that the whole of these native labourers must be supplied with food and clothing by the railway companies. The natives of the country villages would not sell their corn on any terms, as they would thereby be reduced to starvation themselves; for such are the difficulties of transport in India from the badness of the roads, the heat of the climate, the absence of bridges over the rivers, and other impediments, that there may be, and often has been, a famine in one part of the country—when mothers even for a mouthful of food, have been driven to sell their children—and unbounded plenty not many miles distant. It will be necessary, therefore, for the railway companies to collect grain and other articles of consumption in

depôts along the line of country the railways traverse; and it does not appear impossible so to arrange that this grain shall for the most part be paid for in manufactures. If then this be done, and the labourers are paid in part upon the truck system—under such precautions, however, as would prevent it from becoming a grievance—it does not appear probable that any considerable export of bullion from this country would be necessary. The railway labourers would be paid partly in food and partly in clothing—the former having been previously purchased with British manufactures, and the operation of the measure would be to retrieve to some extent the disasters now coming upon the manufacturing districts in consequence of the late deficient harvests. The necessity for providing manufactures, moreover, would facilitate the collection of the capital; for subscriptions in merchandize might be got where it would be impossible to get subscriptions in money; and it would signify nothing in what species of coin the instalments were paid, provided they were all equally effectual in accomplishing the formation of the railways. The Indian railway companies indeed would become large consumers of British manufactures at a time the markets are failing in other quarters; and by the time the consumption ceased from the completion of the railways, new fields would have been opened up, by the accessibility of which a still larger consumption would be occasioned.

Necessity of
the Truck
system on
Indian lines.

Opinions of
the Indian
government
on Indian
railways.

Since the foregoing pages were written the reports received from Calcutta by the India House, relative to Indian railways have been published. Sir J. H. Maddock and Messrs. Millett and Cameron, the members of the legislative department of the Indian government, all concur in the opinion that railways ought to be encouraged; but they consider that this encouragement may be more conveniently given by the concession of the land to the railway companies free of cost, than by a guarantee, which they consider open to objection. The governor-general however, thinks that the encouragement should not be restricted to the gift of land—which may cost perhaps £200 per mile, while the railway may cost £14,000 per mile; he calculates that the saving in the expense of the army, consequent on the formation of the line which connects Calcutta with Delhi, will be £50,000 a year on the lowest scale, and he recommends this sum to be annually given in encouragement of the railway. The members of the legislative department object to a guarantee, on the ground that a bad railway does not deserve a guarantee, and a good railway does not need one: but both of these assumptions are true only under certain limitations and become wholly untenable when extended to the case of Indian lines. The governor-general shows that whether the East Indian line is profitable or not to the projectors, it will save in the military establishments alone an expense of £50,000 a year to the government, and although the developments into which

we have entered, prove that the East Indian line must be a profitable one if judiciously carried into execution ; yet the *theory* that it will in consequence finds abundant support cannot weigh against the *fact* that it is only by the concession of a guarantee that the capital is to be collected. Dividend is not the only element necessary to attract capital ; there must also be confidence, and confidence in Indian projects is likely to spring up in the minds only of that small circle conversant with Indian affairs. As a sailor does not invest his capital in mines, nor a miner in ships, merely because each has confidence only in the things he understands, so the middle classes in this country who are the chief holders of railway property may be expected to exhibit a corresponding repugnance to Indian projects, as for the most part they know as much of India as of paradise. A government guarantee, however, is a thing all can understand, and such an assurance in the present case, is necessary not to obviate risk—for doubtful projects need not be encouraged—but to satisfy persons who from deficient information are unable to form an opinion for themselves upon Indian projects. The members of the legislative department repudiate Mr. Simms' doctrine that the railways should be given up free to the government after a period of years ; but they think that in 25 years they should have the option of purchasing the railways. To this there can be no objection provided the purchase money is ascertained by a reference to the profits during the three last years,

Fallacies of the doctrine that no promising enterprise can require a guarantee.

Duration of
the lease and
terms of pur-
chase.

as prescribed by the statute 7 and 8 Vic. c. 85 ; but there can be no option given of purchasing the railway in 25 years by the redemption of the original capital, unless the offer be accepted now, and the purchase at the end of that time be made not optional but imperative. There is no fairness in the demand that a company shall make a railway to the end that if profitable the government may purchase it at cost price in 25 years, and if unprofitable, reject it : if the railway company has to sustain the risk, the line if purchased at all must be purchased at the value and not at the cost, and must be paid for, not in stock as the legislative department suggests, but in money. With the means of purchase possessed by the government the railway company has no concern, and it is rather a novel doctrine that the price of an article must conform to the necessities of the purchaser.

The legislative department does not think it possible that any agreement can be made for the conveyance of mails, troops and government stores until the railways are completed ; but expresses a hope that railway companies may not be therefore discouraged from proceeding with their works, as the government will be disposed to act liberally, having an interest at stake ; but it is for the security of the *government* and not for the satisfaction of companies, that the terms should be defined at the outset upon which the government service shall be performed, as without some such compact the government will be left quite too much in the power

of the companies. When the railways are made the government *must* use them, however exorbitant the charges may be, and the government would certainly be in a safer position if it were to stipulate now that soldiers shall be carried at the lowest passenger fares, letters at the highest rate for goods, and government stores at the lowest rate for goods, than if it left all these questions undetermined. By devoting an annual grant of money to the encouragement of Indian railways, as recommended by the governor-general, which may be most beneficially expended in the insurance of the guarantee, there is every probability that the whole of the undertakings deserving of encouragement, would immediately proceed, whereas, without such a concession the benefits certain to result from the measure must be indefinitely protracted, and a deep discontent will be created by its miscarriage which it will be found difficult to allay.

Necessary to the safety of the government that terms for conveying mails and troops should be defined.

APPENDIX.

INDIAN RAILWAYS.

(From the Artizan.)

THE momentous subject of Indian Railways is at present attracting much attention both in India and in this country; and public expectation is raised to a high pitch by the anticipated introduction of this new system of locomotion into so magnificent a field. Of all countries in the world, India is probably the one in which the railway system may be expected to work out the grandest results; for in none are the existing means of internal communication more defective, and in none is there such an accumulation of the *materials* of wealth, which need only the addition of facility of transport to bring them into profitable combination. With a density of population in the lower provinces exceeding that of any country in Europe, profound tranquillity, an industrious people, and a soil which yields in rich abundance all the precious productions of a tropical sun, there co-exists such a difficulty of locomotion as to turn these high gifts into barrenness, and to reduce commerce to the lowest ebb. The cotton of Nagpoor and Amrowty which is brought for sale to Mirzapore, a distance of 500 miles, is transported the greater part of the distance upon oxen, which carry 160 lbs. each, and travel, on the average, 7 miles a day. The cost of conveying 160 lbs. 100 miles in this manner is about 5s., and should rain occur during the interval, the cotton is saturated with wet, and becomes too heavy for the oxen to carry; the men and cattle sink in the soft earth of the unmetalled tracks which

stand in the place of roads, and both merchant and carrier are ruined. The general character of the roads throughout the country is of this impracticable description; and products yielded by the soil in rich luxuriance, and for which, if facility of transport existed, a profitable market could readily be found, are suffered to go to waste and to lie neglected.

The same impediments, too, which prevent the products of central India from reaching our shores, prevent our productions from being carried thither; and the formation of Indian railways must, as a collateral benefit, add largely to the consumption of British manufactures, by opening up districts that are at present inaccessible to them. But these views are poor and feeble. If it be a benefit to give a security to our Indian empire, such as it could never otherwise acquire—endowing it, as in the living anatomy, with electric nerves, to telegraph every throb throughout the system to the governing head, and enabling military force to be concentrated upon any point with inconceivable rapidity and effect—if it be a beneficent thing to awaken to a new existence 150,000,000 people on whom the sleep of ages has fallen, by overturning their conceptions of time and space, unfettering their energies, and rousing them to exertion by new incentives—if it be a benefit to draw European settlers into India, who will expend capital on land the railways will make productive, thus furnishing an example to the native population, and leading onward to that course of subsidiary improvement which facility of intercourse will create—then are Indian railways a benefit, and every moment they remain unestablished occasions a loss of wealth and happiness, of which it would be hard to exaggerate the amount.

As a commercial enterprise, the more important of the Indian railways present attractions such as are rarely surpassed in such undertakings, and which we propose to

examine in some detail; but even on the supposition that the railways did not return their expenses, and that the deficiency had to be made up by the Indian government, their formation would nevertheless be expedient, as a greater gain would be realised by such diminutions of the army as the railways would render possible, the superior health of the European troops—which is immediately referrible to a money standard—and the greater ability on the part of the people to bear taxation, than would suffice to balance any loss the working of a railway could occasion. Fortunately there is little need of dealing with any such hypothetical case, as there is very little doubt that whatever railways in India are likely to be made, will return a large profit. But if it would have been a benefit to work Indian railways even at a loss, what must the benefit be when they enrich all concerned?

There are three lines of railway at present projected in India which divide the suffrages of the public. The first runs from Calcutta in the general direction of the Ganges, through Mirzapore and Allahabad, on to Delhi, and it is intended eventually to continue this line to Ferozepore upon the Sutlej, the scene of the late conflicts with the Sikhs: the second extends from Calcutta to a town on the Ganges, 180 miles distant, called Rajmahal: and the third runs from Bombay to Alleh, with extensions to Mhuse and the Pera river, and branches to Sholapoor, Hyderabad, and Indore. The last two are chiefly to be regarded as commercial projects, but the first, in addition to its commercial merits, puts forth the claim of being a great political engine, by which the north-west frontier, which is the most vulnerable part of India, may be secured against future irruptions. Had this railway been constructed at the time of the late wars with the Sikhs, a prodigious waste of life and money would have been averted. Troops that were three months in reaching their destination, and which arrived at the end

of that time worn with sickness and fatigue, could have been transported through the same distance, if a railway had been available, in three days, and with unimpaired health and vigour. The resources of Fort William, moreover, which is the chief magazine in India for military stores, as well as the resources of Allahabad, Cawnpore, Agra and Delhi, would all have been made available for the immediate uses of the army; and a force could have been thrown at any moment on any point of the frontier, in such strength as to overwhelm the enemy and disconcert all his operations. And not only is railway transport the most rapid and effectual for such a purpose, but it is by far the cheapest, even if we do not reckon the saving of time or health it achieves; the cost of transporting troops by railway being actually less than when they are suffered to proceed on foot. Nor is there any danger of this powerful adjunct of military operations, being wrested from us and turned against ourselves, for railways are altogether instruments of defence, and, even though taken possession of by an enemy, they could render him but little assistance. In all probability he would be without carriages or locomotives, and even if he possessed those essentials, the removal of a few rails from the line at intervals, or the demolition of a few of the viaducts, would render the railways useless to an invader. The services rendered by a railway in enabling a small standing army to quell wide-spread insurrection were experienced in this country in 1842, and in India these benefits would be still more extended and conspicuous. They give ubiquity to the ruling power, and concentrate the strength of the empire into a focus—thus turning doubt into security, and making small means great.

The political fruits of the line leading from Calcutta to the north-west frontier are of so important a nature that the Indian government may naturally be supposed to be

impatient for its formation. Its commercial prospects, however, are equally alluring, and it may be doubted whether they do not transcend those of any other railway in any other country. Mirzapore, one of the points through which this line passes, is the great mart for the productions of Central India, while the value of the exports and imports of Calcutta is about £16,000,000 a year, of which, probably, the greater part passes in the direction the proposed railway will follow. Above Mirzapore again, on the road between Allahabad and Cawnpore, an immense traffic exists, the amount of which is given in Mr. Macdonald Stephenson's Report upon Indian railways, from which we gave some citations in a former number; and on the road leading to Burdwan, which is about 80 miles from Calcutta by the track the railway would follow, there is a very great trade in salt, coal which is mined there, goor, and other articles of large consumption. Mirzapore is about 448 miles from Calcutta, and the journey thither and back by Dawk occupies at the least 10 days, and involves an expense of £60. By the steam vessels on the Ganges, which proceed from Calcutta to Mirzapore, the expense is not less, and the time occupied is four times greater, while the length of the journey by railway would not exceed 15 or 16 hours. Goods are transported by land from Mirzapore to Calcutta only with great difficulty and at immense expense: much merchandise is lost or damaged in crossing the rivers, especially the Saone, a large river which runs into the Ganges, and which presents many engineering difficulties to the construction of a bridge. The rate of freight charged by the steamers on the Ganges between Mirzapore and Calcutta is about £2 10s. per ton; the speed does not exceed 50 miles a day; and, as the vessels have to stop by night, the voyage is very tedious. The ledges and shallows in the Ganges above Allahabad prevent the steamers from proceeding farther up than that place, and the sharp rocks in the bed

of the Jumna present a barrier in that river equally insurmountable. The navigation of the lower part of the Ganges, again, is beset with serious difficulties. The head of the delta is situated at Rajmahal, about 180 miles north of Calcutta, and at this point the Bhaugirruttee and Jellinghi branches break off from the main stream, and uniting their waters at Nuddeya constitute the Hooghly, which flows past Calcutta into the Bay of Bengal. The navigation of these offshoot streams is always difficult, and during a considerable part of the year impossible; and the steamers are compelled to make a circuit through the perilous labyrinths of the Sunderbunds, and to pass through a distance of 528 miles to reach a place only 180 miles distant. These impediments to the navigation of the Ganges constitute a limit to the competition that river can offer to a railway, as well as a reason for the formation of one, and although the navigation of the Ganges could no doubt be improved, yet the amelioration would involve a large expenditure, and it does not appear probable, from the examinations which have been made, that the improvement could be extended to the Bhaugirruttee channel, which, even if deepened and opened up, would, it is said, soon become choked again with alluvial deposit, though this doctrine we think requires confirmation. But there is no measure of improvement the navigation of the Ganges could receive, that is capable of realizing for the country the political and social benefits the institution of the proposed railway would confer; and the necessity for its formation, therefore, any such improvements, even if accomplished, could not supersede.

We have already mentioned that one of the Indian railway projects is the formation of a line between Rajmahal and Calcutta; and in Calcutta this line is, we believe, popular, especially among the persons interested in the success of the steamers on the Ganges. The author of a small work upon Indian railways, who writes under

the patronymic of "An Old Indian Postmaster," displays much zeal in the advocacy of this project, on the ground that the navigable part of the Ganges affords sufficient locomotive facilities to the regions through which it passes, and that it is more judicious by tacking railways to the end of this navigable portion extending from Rajmahal to Allahabad to supplement the defects of the Ganges, than to construct a railway with which the Ganges must compete. It reveals, however, we fear, a rather Indian conception of what constitutes sufficient locomotive facilities for a great country, when those facilities are supposed to be afforded by a speed of 50 miles a day, or about 2 miles an hour; and we hardly think the achievement of such a result will, in the estimation of unbiassed persons, be regarded as superseding the necessity for Indian railways, or that railways need apprehend the consequences of such a competition. No doubt the Ganges, even if a railway is opened from Calcutta to Delhi, will still be used for the purposes of internal transport; many heavy articles for which speed is no great consideration, instead of being carried by the railway, will be carried by the river. But it appears very doubtful to us whether those articles, or, indeed, any of the articles then transported by the river, would be unladen at Rajmahal, even if a railway were conducted thither; and we humbly conceive that, so far as the Ganges trade is concerned, it would be much more benefitted by the formation of the Rajmahal canal, projected by Col. Forbes, on such a scale of magnitude as to enable the vessels navigating the Ganges to pass through it without the necessity of transshipment, than by any railway that could here be made. A railway from Rajmahal can never become a substitute for a railway to the north-west frontier, and we have yet to learn what effect the formation of the latter line will produce upon the trade of the Ganges, as it bears upon a railway to Rajmahal. Will

not the railway to Delhi and the north-west frontier, or, as we believe it is called, the East Indian Railway, take from the vessels on the Ganges the great bulk of the passengers, and the finest articles of merchandise, for which alone speed is of importance? And if nothing is left for the Ganges trade but coarse and heavy cargo which does not require speed—is it likely that such cargo would be unloaded at Rajmahal, subject to all the expense and risk by transshipment and loss by peculation, to be conveyed from thence to Calcutta by railway?

The distance of Mirzapore from Calcutta we have already stated as 448 miles. Delhi is 452 miles from Mirzapore, and the north-west frontier is about 260 miles from Delhi. Taking the distance of Rajmahal from Calcutta at 180 miles, though 200 miles would probably be a nearer approximation, it appears that by adopting the route by Rajmahal to the north-west provinces, and taking the Ganges between Rajmahal and Allahabad, as the Old Indian postmaster suggests, as part of the connecting chain we save only about one-third of the length of railway in proceeding to the north-west frontier, while for the sake of saving this third we increase the distance and extend the time so much, that a good mail coach running on a turnpike road, would be more expeditious than such a hybrid system of communication. It is clear, therefore, that even if the commercial aspect of the question be alone regarded, it is impossible that the Indian government can adopt the 'Old Indian Postmaster's' suggestion of making the Rajmahal the initiatory line. It is very doubtful whether the formation of that line at all is expedient, and what magic is there in the Rajmahal line to compensate the government for the loss of all those political benefits the postponement of the East Indian line would occasion? How could an army be precipitated upon the frontier with a rapidity to confound all machinations, if the patchwork

line of the 'Old Indian Postmaster,' with all its drags and complications were to be the only dependence? If an army were to be brought to Rajmahal, how could it be sent forward? It is clear the steamers on the Ganges could not convey such a multitude, and what would be the time occupied if they were carried only in successive voyages? It is question whether, with *such* means of acceleration, time would not be saved by marching by the road, and the result would be, if the 'Old Indian Postmaster's' plan were adopted, that after the loss of much valuable time in a vain experiment, the benefits due to railways would remain unrealised until a continuous line was constructed—which moreover might render valueless the line first made. The establishment of the electric telegraph, which we understand the East Indian railway company proposes to carry to the frontier, appears to be scarcely possible except upon a direct line; and such an instrument appears to us calculated to render important services to the government, by binding remote parts of the empire into close proximity. It is at present contemplated, we believe, to complete only parts of the East Indian line—one portion leading from Calcutta to Burdwan, and another portion through the Doab, between Allahabad and Cawnpore. But we think the Indian government should require the railway company to open up the whole line to Delhi without delay, as there is a serious loss in any postponement of such a measure if the benefits are as great as are asserted. The political ends of the line cannot be compassed unless it be unbroken; and in the present unsettled aspect of affairs in Lahore, it would be most unwise, we conceive, for the government to shut out the aids an unbroken railway communication is able to afford.

It is unnecessary to dwell upon the physical features of the proposed East Indian Railway, as they are fully set forth

in the report of Mr. Simms and his coadjutors, which we published in a late number. The district through which the railway runs is upon the whole wonderfully free from engineering difficulties of every kind, the only one of any prominence being the bridging of the Soane, a large river flowing over a bed of sand; but even here the question is one only of expense. The ravages committed by the white ants in India upon ordinary timber, involves the necessity of using some preparative process such as Kyan's; and it is found that when timber is thoroughly impregnated with such a preparation by hydrostatic pressure, or by introducing the preservative liquid into the live tree, it may henceforth be reckoned safe against the ravages of the white ants as well as against the dry rot. It is doubtful, indeed, whether the white ants would attack timber subject to such violent vibrations or concussions as railway sleepers have to withstand; but nothing should be risked in a matter of so much importance; and unless stone blocks be employed, or sleepers of Moulmein ironwood, or cast-iron attachments, such as are used on some of the American lines, sleepers that have been prepared by some effectual curative process should be adopted throughout the line. The last alternative is the one of which we approve, inasmuch as timber has been found preferable to stone for railway foundations, and the preparation of wood by Kyanizing or some equivalent process, is the method of which we have most experience for securing it against dry rot or the ravages of insects. No doubt this preparation of the timber will add to the expense; but on many of the English lines this method of preparing the timber is adopted, and it does not appear probable that the cost of the line between Calcutta and Delhi, though formed with a double line of rails, and constructed in the most substantial manner, will exceed £15,000 a mile. It is false economy in the case of a great

trunk line, such as the East Indian Railway, to be content with any but the most complete and substantial modes of construction. The gradients too should be good, and the line direct, without turning to the right or left to pass through neighbouring towns, which may be adequately accommodated by branches; for in all human probability this line will not stop at the frontier, but will pass on into Persia, and perhaps eventually into Turkey, until it at length reaches Constantinople; and then we shall be able to pass from London to Calcutta in little more than a week. We know that to most persons this will appear a very visionary expectation; but in every thing relating to the achievements of steam, the visionary people have been far oftener right than those who plume themselves so much upon their practical sagacity. It was *visionary* not twenty years ago, to talk of a speed exceeding ten miles an hour on a railway; it was *visionary* to expect that steam vessels should navigate the open ocean; it was *visionary* to maintain a regular steam communication with India by the way of the Red Sea and the Egyptian desert; it was *visionary* to connect Ostend by railway with Constantinople, which is now doing or done; and until the other day it was *visionary* to project a railway from Calcutta to Delhi. Every great step in the world's progress has at the first been visionary; but the rapidity with which steam works its enchantments, confounds the arithmetic of practical stolidity. Practical men, it appears, have yet to learn, that in such anticipations "to doubt is to rebel," and that in resolving the question of the probabilities of human progress, rashness lies in scepticism rather than in faith.

We fear these remarks have drawn out to too great a length to enable us to say much respecting the third scheme to which we have referred, which has its terminus at Bombay, and of which the Great Indian Peninsula Company are the promoters. Nor are we sure that any discussion

of its merits would not be premature, as we scarcely think it probable that the Indian Government, after having secured to itself the benefits of the Political line, will, until after it has been tested, offer sufficient encouragement to any other railway to induce its construction. Such a delay is nevertheless to be regretted, especially as, if Bombay were to be connected with Calcutta by railway, the length of the voyage to England would be considerably abridged. As regards the Bengal lines, the political grounds will necessarily determine the decision of government to adopt the trunk line at once, and if they can profit by the experience of the past, they will place all the branches under one company's management.

There are many benefits arising from such concentration ; but we have considerable doubts whether there is any benefit to be derived, and, indeed, whether there is not a very material detriment in distributing the construction of segments of railway among different companies who may have conflicting interests, and among whom it may be difficult to preserve the concord necessary for the public service. In England the inconveniences of the system have been found to be so great, that the different companies have spontaneously proceeded to redress them by amalgamation, and wherefore should a system be introduced into India that has in England well nigh wrought its own extirpation ? If amalgamation be beneficial, it would surely have been *more* beneficial if there had been no separation ; economy is promoted by one management, strength consolidated, and unanimity secured ; and we therefore do think that it behoves the Indian Government, in introducing railways into India, to deal in each district only with one party, from whom conditions more favourable to the public service may then be exacted. Against this there would of course be the outcry of monopoly, but there would be no reason in such a cry ; for, so long as the lines

do not compete with one another, there is no more monopoly in the possession of the lines by one company than in their possession by any number. The monopoly of the London and Birmingham Railway Company is not diminished by the formation, by a different company, of a railway from Perth to Aberdeen; and wherein, then, could the monopoly of a railway from Mirzapore to Calcutta be diminished by the formation, by a different company, of a railway from Delhi to Mirzapore? Monopoly is not diminished in amount by being broken into fragments, but as it becomes more impalpable, it becomes more obnoxious in its exactions. To any kind of monopoly in locomotion we have always been opposed, and with the example of the intolerable oppression of the railway monopolies in this country, we trust the Indian government will take effectual precautions against the introduction of such a system into India. But these precautions are afforded, not by a multiplication of companies, but by restricting the profits of each; by providing that the government shall have access to the books, and shall possess the power of reducing the fares when the dividends become very high, and insisting on the condition that whatever lines may be constructed shall be formed under government supervision, conducted under government sanction, and be hereafter purchaseable by the government at a fair valuation. It is not difficult we are aware, to evade any condition respecting the restriction of profits, and it is therefore worthy of consideration, whether instead of providing that all above a certain rate per cent. went to the government, it would not be preferable to award only a portion of the sum in a ratio increasing with the dividend, so that the company would still have an interest in making the profits as large as possible. The rates charged for the conveyance of passengers and merchandize, should be gradually diminished until the railway attracted to itself the conveyance of the agricultural pro-

duce, whereby a larger revenue is to be realized with greater advantage to the country than if a high rate of charge were to shut it out. With these concessions we think it only reasonable that the Indian government should guarantee to the railway company the moderate interest upon their money of 4 per cent; for the money necessary for the construction of Indian railways must be raised in England, and we should suppose that it would be difficult without such a guarantee, to collect the capital necessary for the purpose. A difficulty might perhaps be supposed to be presented by the uncertain tenure of the East India Company's charter; but in an affair of so much importance the English government would be singularly remiss or perverse if it failed to delegate the powers necessary for the accomplishment of such an object; for such interventions in reality constitute the most important of the functions a government has to perform.

The constitution of the East Indian Railway Company is, we think, a favourable one for introducing railways into India with success. The governing directory will be located in England, and efficient paid servants will be chosen in India for carrying its instructions into effect. This arrangement—independent of its obvious sequency from the almost exclusive use of English capital—is rendered expedient by the fact, that joint stock companies have never been known to succeed in Calcutta, but have, in every case, become the theatre of jobbery and intrigue. Oriental morality appears to be of too lax a quality to render possible the success of the undertakings entrusted to its guardianship; and it appears indispensable therefore that the management of the proposed company should be undertaken by English merchants, who have already given proofs of their eligibility for such a trust. The value of money in India is much too great to encourage the expectation that much of the capital for railways will be subscribed

there—though indeed the effect of the introduction of railways will be to double or quadruple the capital of the country, by enabling the interchanges of commerce to be effected three or four times more rapidly than before. But this effect cannot be antecedent to the institution of railways, and on the resources of English capital their formation must depend. With these cursory remarks we must at present dismiss this important subject; but we trust on an early occasion to be able to turn to it again, and to acquit ourselves of the duties of the investigation, with greater patience and success.

DRURY, PRINTER,
XXXI, BARTLETT'S BUILDINGS, HOLBORN, LONDON.



